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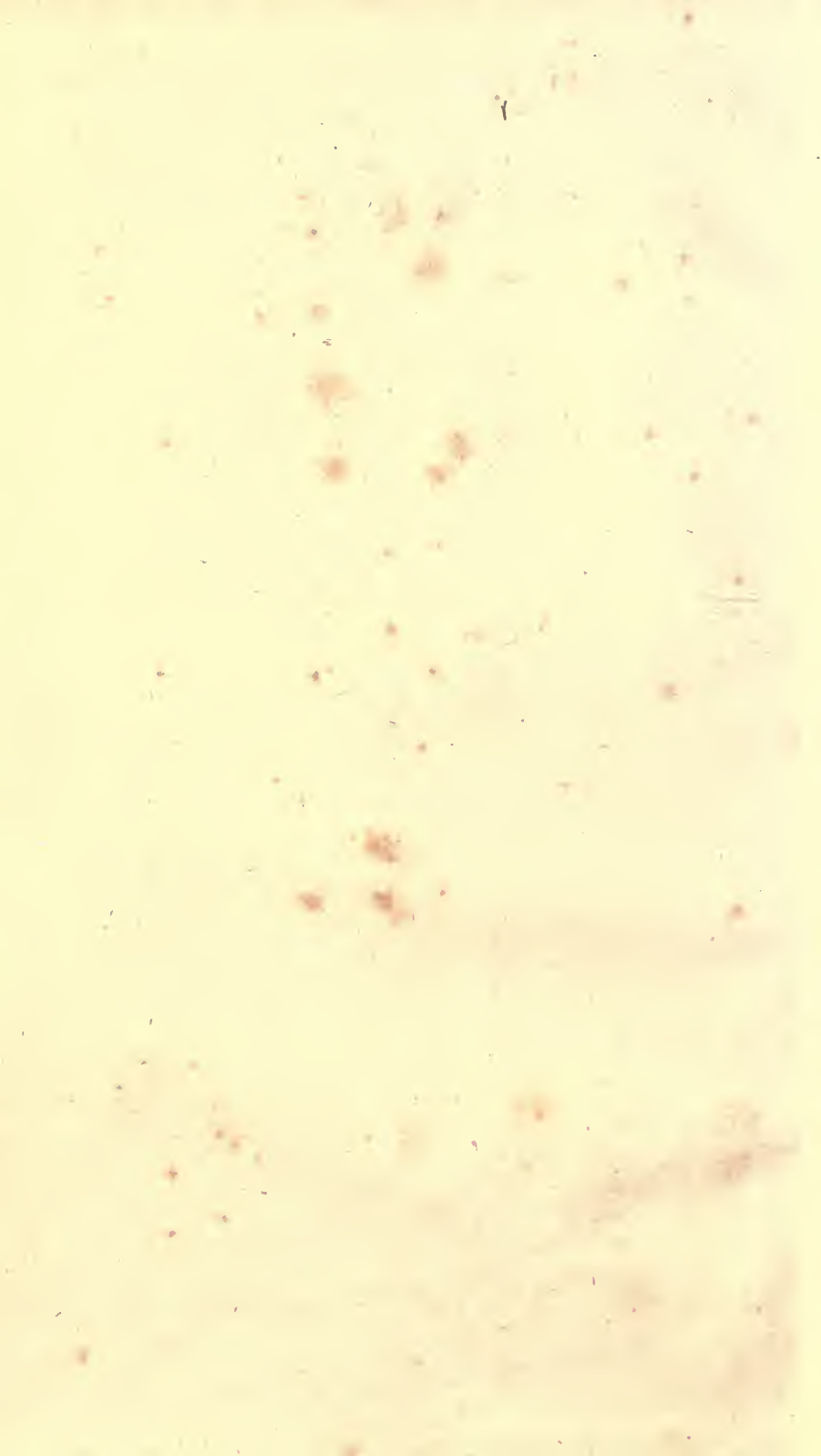
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PRACTICAL MINERALOGY;

OR,

A COMPENDIUM

OF THE

DISTINGUISHING CHARACTERS OF MINERALS.

BY WHICH THE NAME OF ANY SPECIES OR VARIETY IN THE MINERAL
KINGDOM MAY BE SPEEDILY ASCERTAINED.

BY EDWARD J. CHAPMAN.

ILLUSTRATED WITH THIRTEEN ENGRAVINGS, SHOWING TWO HUNDRED
AND SEVENTY SPECIMENS.

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TO THE ILLUSTRIOUS SWEDE,
BERZELIUS,
AN ENGLISH STUDENT
DEDICATES THIS HUMBLE VOLUME,
HIS FIRST WORK,
AS A SLIGHT THOUGH SINCERE TOKEN
OF GRATITUDE,
FOR HAVING HAD MANY A SOLITARY HOUR
CHEERED AND RENDERED BRIGHTER
BY A PERUSAL AND STUDY
OF HIS LABOURS.



P R E F A C E.

IT has been said "that there is no treatise, by a reference to which the beginner is enabled, if he take up a mineral, to arrive at once at a knowledge of its nature."* Now, some years previously, an attempt had been made to accomplish this desired purpose,† and another‡ has since been published with the same design, but of a far higher character. These two works are, I believe, the only *original* attempts of the kind that have ever been made public,|| and in offering the present volume to the mineralogical world, as a third attempt, I beg to point out the reasons which have led to its compilation.

A glance at the system of AIKEN (speaking of it of course as an artificial arrangement), will show that in many respects it

* 'Phillips's Mineralogy.'

† 'A Manual of Mineralogy,' by ARTHUR AIKEN, Secretary to the Geological Society. London, 1814.

‡ The 'Grundriss der Mineralogie' of PROFESSOR MÖHS, 1822—1824. The well-known English translation of this work, by WILLIAM HAIDINGER, Esq., F.R.S.E., appeared in three volumes in 1825. The later works of PROFESSOR JAMESON, and the 'Manual' of Mr ALLAN (Edinburgh, 1834), are in system but transcripts of the arrangement of Möhs, as improved by HAIDINGER.

|| I say *original* attempts, as in 1827 a small work was published at Glasgow, well known by the title of 'Griffin on the Blow-pipe,' which consists of two separate parts, the first relating to the use of the blow-pipe, chiefly compiled from the celebrated work by BERZELIUS, and the second being a condensed and slightly altered copy of AIKEN's system, then long out of print.

does not answer the purpose to which it was applied, besides the numerous species which have been discovered since the publication of this treatise, the divisions which have been made, and the new properties found, in those previously discovered, the more rigorous application of the external and chemical characters of minerals, their modern scientific arrangement, &c., &c., would serve to prevent this once deservedly-popular manual from being of much use at the present day,* even were it not, as it has been for many years, out of print, and very difficult to procure.

The system of MÖHS is so generally known, that it is unnecessary to enter here into a detailed account of it; it may be merely considered under two heads, viz.:—

As an Artificial Arrangement, for the distinguishing of mineral substances one from another—

2 And, as a Systematic Classification, for the grouping together of mineral substances after a certain natural order.

3 Under the first head it may be merely stated that the external characters alone are made use of; the principal of these being crystalline form, hardness, and specific gravity. Now, the investigation of crystalline form as propounded by MÖHS, for the determination of mineral substances, requires in the student an advanced knowledge of mathematics, and a nice degree of skill in applying this knowledge to nature, which is not often found in practical persons or unassisted students. It likewise requires the aid of a delicate and rather expensive instrument, but independently of this, it exacts that we should operate on crystals or highly crystalline specimens, which, comparatively speaking, are rarely found in nature, and are always very expensive to purchase. Consequently this system is often quite unavailing for the determination of small fragments or massive specimens, and the more

* It is this fate which awaits, in a greater or less degree, the works of all writers on scientific subjects. Years roll by, and that which once held "pride of place," is gradually eclipsed and rendered obsolete, by new and succeeding discoveries.

so as the degrees of hardness attached to the species are those of the crystallized varieties, and, in many instances, do not at all correspond with those of the amorphous specimens, which are considered by MÖHS as impure or imperfect bodies, and as such inadmissible into a mineralogical system. But in concluding these brief remarks on the system of MÖHS, viewed as an artificial arrangement for the determination of minerals, I beg to quote the words of DR THOMAS THOMSON,* which bear so fully on the subject as to render further digression on this point unnecessary.

“MÖHS has arranged all minerals in what he calls a *natural history* order. The object of his arrangement is (to enable a beginner to discover the name of any mineral contained in the system by its characters, precisely in the same way as in botany or entomology, any plant or insect contained in the system may be discovered by attending to its characters.) And M. MÖHS considers it as a vast advantage to mineralogy to be thus freed from the trammels of chemistry, by which it has been hitherto hampered.

“It would certainly be a boon to mineralogists, of no mean value, if a method could be devised to enable a student to discover the name of any mineral contained in the system. But from the very nature of minerals the discovery of such a method is attended with much greater difficulty than in the other branches of natural history in which organized beings are arranged; because, in them the form and peculiar structure of the respective organs afford accurate and characteristic distinctions. The only thing analogous to organization in minerals is the form of the crystal; but to be able to deduce accurate distinctions from these forms requires a previous acquaintance with crystallography, which can only be obtained by the study of crystals. That is to say, that before we be in a condition to discover the names of minerals from their crystalline forms, we must be acquainted with them.

* ‘Outlines of Mineralogy, Geology, and Mineral Analysis,’ vol. i, p. 6 & 7.

Besides, minerals do not always occur crystallized ; and in such cases our *characteristic* would be totally at fault, and would leave us incapable of drawing any conclusion.

“ M. Möhs gets over this difficulty by affirming that crystallized minerals alone belong to mineralogy as a science ; that amorphous minerals are mere aggregates of minute crystalline particles incapable of description or arrangement. But supposing this to be a correct view of the subject, still, if mineralogy were to be confined to mere crystallized bodies, it would be divested of the greatest part of its utility ; for a very great proportion of those minerals that are of the greatest utility to man, and which, therefore, it is peculiarly important to be able to distinguish from others, are seldom found in the state of regular crystals. How often do the ores of tin, copper, lead, and iron occur in an amorphous state ? And were a mineralogist incapable of distinguishing them from each other, and from other minerals, except in the rare cases when they assumed a regularly crystallized form, his knowledge would be useless as far as the important arts of mining and metallurgy are concerned.”

If we now regard this system as a classification for the grouping together of mineral substances after a certain natural order, the case will be still worse. Far from being a *natural* system, it is a system of nature perverted ; unreal and unsatisfactory ; a system of what things *seem to be*, not of what they *are*. As though the founder, incapable of following nature through its mighty and wonderful paths, had risen up in rebellion against it, and endeavoured (how vainly !) to restrain it within the bounds of his own cramped imagination ; and it only shows how the human mind, even when as highly gifted and talented as that of Möhs, may be curbed and led away by its own preconceived prejudices.

These words, used by a young man and unknown student, towards one in every respect his superior, may be considered presumptuous and unbecoming ; but it must be remembered that

he is but attempting to free "our common mother" from the shackles which great yet misapplied talents have cast upon her. For certainly, had this system, in despite of common sense, made head in England (and it is to be much regretted that one noted professor of Edinburgh, and other able writers have adopted it), its baneful effects would have been most withering to the growth of our mineralogical science, and have kept its votaries far below those who had studied in more natural and less arbitrary schools.

It thus appears that hitherto there has appeared no treatise in this, nor to my knowledge in any other language, peculiarly adapted to the wants of the student, in enabling him to discover easily the name of any mineral, fragmentary or otherwise, that he may chance to meet with, and pointing out to him likewise at the same time its true place in the scientific system. Whilst upon this latter subject, I may perhaps mention, that it has often occurred to me, in how poor a light must continental mineralogists regard the followers of their science in this country, when they view the weak and unscientific arrangement still retained in our most popular, in fact, our only popular, work on the subject, 'Phillips's Mineralogy.'

With this view, to enable the student to discover easily, and without recourse to crystallographical calculations, the name and nature of any mineral that may fall into his hands, and to assign it a place in a system at once natural and scientific, I have drawn up and published the following volume. In its compilation I have of course made more or less use of the works of my predecessors, even as they have made acknowledged use of the works of preceding writers, but in no instance have I done so carelessly or slavishly, in the spirit of a mere compiler, but have taken nothing for granted, except in a few instances where I could not procure specimens, that I have not carefully and rigorously examined; so that whatever errors the volume may contain, and it certainly must contain some few, I think it will be accorded to

me that, for clearness and correctness, its descriptions, brief though they necessarily be, may suffer a comparison with those of other works.* In a word, it has been my wish and aim to make it, though concise, yet sufficiently complete, to serve the travelling mineralogist in lieu of a more bulky work of reference, which might cost three times the price, without containing more necessary information.

Before I conclude, I would mention again my general obligations to the writings of BERZELIUS, PHILLIPS, MÖHS, ALLAN, BEUDANT, JAMESON, and other authors; my more particular obligations are the following.

The "Characteristic Effects of the Metallic Oxides on the principal Fluxes," at the close of the first chapter, are extracted, with a few additional remarks, from the work on the Blow-pipe† by BERZELIUS, but for the sake of convenience, I have arranged them in three groups, as will be there seen.

* To the pyrognostic characters of minerals I have paid particular attention, as, from the nature of the Artificial Arrangement (especially in the *groups*), it will be seen that no indefinite terms would have been of use. As an example, I may refer to the PREHNITE, which in other mineralogical works is merely stated, with the STILBITE, &c., to be fusible, with intumescence, before the blow-pipe, thereby conveying the idea that these minerals were not to be distinguished by it, the one from the other, whereas the contrary is the case, as shown below.

Stilbite, Chabasite, &c. These minerals, before the blow-pipe, become opaque, and throw out ramifications in the manner of borax, fusing afterwards *quietly* and rather slowly.

Prehnite. Does not throw out ramifications before the blow-pipe, but swells and fuses immediately *with great and continued bubbling*. The *Datholite* behaves in the same manner, except that it yields a clear glass, the *Prehnite* giving a very blebby one. As the *Axinite* and other minerals containing boracic acid fuse also with bubbling, might not one be led to suspect the presence of this acid also in the *Prehnite*, or of some other substance, in minute quantity (fluorine perhaps), not indicated in the past analyses, which causes the phenomenon, by escaping in the gaseous state during the fusion of the mineral?

† The excellent English translation, with notes, &c., of this justly-celebrated treatise, by J. G. CHILDREN, Esq., has been, unfortunately for the

The "Arrangement of Minerals" in the third chapter (page 158) is an original modification of that masterly classification, due, I believe, to the labours of BEUDANT and BERZELIUS, by the latter of whom it was brought to its present perfection. This arrangement has not been adopted, nor, to my knowledge, given, in any English work on Mineralogy.* I therefore trust that it will not be unacceptable in the present place.

The lithographed figures, which are merely added to make the volume more complete, and to enliven the descriptions, have been chiefly selected from the numerous plates given in the two volumes of the second edition of BEUDANT'S '*Traité de Minéralogie*,' these having, in their turn, been compiled from the works of HAUVY, BOURNON, and other writers who have particularly attended to crystallography. For some few, I am also indebted to MÖHS, PHILLIPS, and other authors. These figures, which are all different, amount in number to 305, and though their delineation cannot boast, perhaps, of any very great angular accuracy, yet they are drawn correctly enough to answer all ordinary purposes, and will serve to point out the connexions between the primary and the various secondary forms.

In conclusion, I beg to observe, that I have added a long and particularly copious index, forming, in fact, a complete table of synonymes for all English, German, and French authors, the

English student, long out of print, and has now become exceedingly scarce. French translations are, however, easily procurable through any of the foreign booksellers, and cost in this country about six or seven shillings; but if the reader be unacquainted with that language, and not possessed of the above treatise, he should try to procure the before-mentioned work on the blow-pipe, by GRIFFIN, as it contains the most essential parts of BERZELIUS'S Essay, with several useful additions.

* A brief, descriptive account of the minerals in the BRITISH MUSEUM, arranged after the electro-chemical theory of BERZELIUS, by C. KONIG, Esq., is, however, published annually, with the other catalogues appertaining to that establishment. The arrangement of the elementary bodies in the present volume is original.

utility of which I need not attempt to demonstrate; and though well aware that this little work is by no means perfect, yet in stating that its author is a very young man, that he has had in its construction to rely wholly upon himself, and that it has been written at broken intervals, amidst the study and practice of his profession (that of an engineer), I trust that its faults will be excused and kindly pointed out, and that its merits, or rather its utility, will be found to outweigh them.

Westminster, September 5, 1843.

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POSTSCRIPT.

As the minerals comprising the scale of hardness constructed by Professor Möhs (see page 4) may not be always at hand, especially in travelling, the following scale exacting only objects always to be met with, and which agrees, in its most essential respects, closely enough for practical purposes with the scale of Möhs, may be sometimes found convenient, but the minerals and file should always be used in preference, if possible :

- 1.—Yields easily to the nail.
- 2.—Yields with difficulty to the nail, or receives merely an impression from it. Does not scratch a copper coin.
- 3.—Scratches a copper coin, but is also scratched by it, being of about the same degree of hardness.
- 4.—Not scratched by a copper coin. Does not scratch glass.
- 5.—Scratches glass, though rather difficultly, leaving its powder on it. Yields easily to the knife.
- 6.—Scratches glass easily. Yields with difficulty to the knife.
- 7.—Does not yield to the knife. Yields to the edge of a file, though with difficulty.
- 8—9—10.—Harder than flint.

Note.—2·5 scratches a copper coin slightly, and 3·5 is scratched by one in about the same degree.

ERRATA.

The reader is requested to correct the following principal Errata, before perusing the volume.

Page 16, line 4 from bottom, for "boracic acid 14·50," read "boracic acid 37·0."

Page 19, line 3, for "briskly," read "feebly."

Page 25, top of page, for "Group II," read "Group I."

Page 37, line 17 from bottom, for "contains" read "contain."

Page 45, line 6, for "162, 163, 164," read "162a, 163a, 164a."

Page 45, line 25, for "3·7" read "3·9."

Page 47, line 3, *after* "Lepidolite" insert a semicolon.

Page 55, line 3 (of Tremolite), for "9·9" read "5·5."

Page 58, line 4, *add* "potassa 7·30."

Page 81, for "SARTALITE," read "SPARTALITE."

Page 113, line 2 from bottom, *after* "Red Sea," *omit* the semicolon.

Pages 161 and 162, for "Ox." read "O."



PRACTICAL MINERALOGY,

ETC.

CHAPTER I.

1. Distinctive Characters of the Parts, Divisions, and Sections, to which all Mineral Substances are referred, in the Artificial Arrangement of Minerals, in Chapter II.*

† Characters of the Parts.

Part I. General aspect, or lustre, not Metallic.

Part II. General aspect, or lustre, Metallic.

†† Characters of the Divisions.

- Part I. { Div. I. Gaseous, liquid, or semi-fluid.
Div. II. Solid; hardness below 5·5.
Div. III. Hardness=5·5—10·0.
Part II. { Div. I. Hardness=0·0—3·0.
Div. II. Hardness=3·5—6·5.

††† Characters of the Sections.

PART I.

Division I.

Sect. 1. Gaseous.

Sect. 2. Liquid, not inflammable.

Sect. 3. Liquid or semi-fluid, inflammable.

Division II.

Sect. 1. Sapid; soluble in water.

Sect. 2. Effervescent in acids.

Sect. 3. Highly inflammable, burning in the flame of a candle, or very easily before the blow-pipe.

Sect. 4. Soiling strongly; otherwise crumbling, becoming plastic, or falling to pieces when placed in water.

Sect. 5. Yielding an alliacious odour before the blow-pipe.

Sect. 6. Not exhibiting any of the above characteristic signs; fusible before the blow-pipe.

A. Streak, white or grey.

B. Streak, neither white nor grey.

Sect. 7. Infusible without addition before the blow-pipe.

A. Streak, white or grey.

B. Streak, neither white nor grey.

* For the farther subdivisions (into groups, &c.), the reader is referred to the remarks prefixed to each Section, in the body of the work.

Division III.

Sect. 1. Hardness=5·5—6·5.

A. Fusible without addition before the blow-pipe.

B. Infusible without addition before the blow-pipe.

Sect. 2. Hardness=7·0—8·0.

A. Fusible without addition before the blow-pipe.

B. Infusible without addition before the blow-pipe.

Sect. 3. Hardness=8·5—10·0.

PART II.

Division I.

Sect. 1. Fluid or semi-fluid.

Sect. 2. Solid ; malleable or ductile.

Sect. 3. Solid ; not malleable.

Division II.

Sect. 1. Malleable or ductile.

Sect. 2. Not malleable ; but attractable by the magnet,
either before or after roasting.

A. Fusible without addition before the blow-pipe.

B. Infusible without addition before the blow-pipe.

Sect. 3. Not malleable ; and not attractable by the magnet,
neither before nor after roasting.

A. Fusible without addition before the blow-pipe.

B. Infusible without addition before the blow-pipe.

2. Method to be observed in examining an unknown Mineral Substance, in order to discover its Name, &c. by this Work.

This will be the more easily explained and understood by referring to examples. Let us, therefore, suppose ourselves to be possessed of three mineral substances, whose names are unknown to us, but which we wish to discover ; and let these substances be—Chromate of Lead, Tin-pyrites, and Lievrite.

Commencing with the first, we turn to page 1, and there find that all minerals may be arranged in two great groups or parts ; the first possessing a non-metallic, and the second a metallic, lustre. Now it must be quickly evident that the mineral under examination belongs to Part I ; therefore we must descend to the Divisions of this Part, which we find to be three in number—

Div. I. Gaseous, liquid, or semi-fluid.

Div. II. Solid ; hardness below 5·5.

Div. III. Hardness=5·5—10·0.

And upon examining the mineral whose name we wish to discover, we find that its degree of hardness is about equal to 2·5 : which at once excludes it from either the first or the third Division, but not from the second, to which it must consequently belong.

We have now only to proceed to the Sections of this Division of Part I ; and commencing with the first, we must descend regularly from each section to the one below it, until we come to that whose characters do not exclude the mineral in question from belonging to it.

x Now it is excluded from Sect. 1, by not possessing any taste; from Sect. 2, by not effervescing in diluted nitric or muriatic acid; from Sect. 3, by not being inflammable; from Sect. 4, by not soiling, nor falling to pieces when placed in water; from Sect. 5, by not yielding any alliacious odour before the blow-pipe: it must, therefore, belong to Sect. 6 or Sect. 7, which do not possess any of the above characteristic signs. Now, Sect. 6 includes those minerals which are fusible *per se* before the blow-pipe, whilst Sect. 7 includes those which are not so; and as the mineral in question is fusible without addition, it must belong to the former. We now find that Sect. 6 is divided, for convenience, into two Sub-sections—

A. Streak, white or grey.

B. Streak, neither white nor grey.

And trying the colour of the streak in the mineral under examination, we find it to be orange-yellow; consequently it must belong to the latter group B, of Sect. 6; or, at one view, to Part I, Division II, Section 6, B.

We now turn to the Description of Minerals in the next Chapter, where we find arranged, under the above Part, &c., all the mineral substances which can belong to it; and going carefully over these, comparing *strictly* at the same time its hardness, streak, comportment before the blow-pipe, and other characters with those there detailed, we cannot fail to discover its name with the greatest ease and certainty: so that it would be superfluous to carry on the examination further in this place.*

Let us now proceed to the second mineral—Tin-pyrites, a sulphuret of tin and copper.

We find its lustre to be metallic, consequently it must belong to Part II.

We find its hardness to equal 4·0, consequently it must belong to the second Division of this Part.

We find that it is not malleable; neither is it attractable by the magnet, either before or after exposure to the blow-pipe, consequently it is excluded from Sections 1 and 2, and must belong to Section 3 of this Division.

We find that it is fusible *per se*; it consequently belongs to A of this Section, or, at one view, to Part II, Division II, Section 3, A.

If we now turn to this Part, &c., in the description of minerals in the next chapter, and carefully compare its characters with those of the few substances there detailed, its name will be at once made evident.

The third mineral, Lievrite, has been selected as possessing, in some of its varieties, in common with several other minerals, a semi-metallic

* It will be seen, on referring to the Sub-section indicated, that it contains only four other minerals which possess a yellow streak. Two of these occur only in a pulverulent state, and the two others have each a light yellow streak; whereas that of the Chromate of Lead is orange-yellow. Its colour is also totally different, its specific gravity about three times as high, and it yields (which neither of the others do) globules of reduced metal before the blow-pipe.

aspect, or a lustre between non-metallic and metallic, which might at first cause some perplexity in the reader's mind as to which of the two parts these minerals ought to belong; but as they are arranged and described in both, no error can arise from his placing them with either, as may be instanced in the case of the above-mentioned mineral, Lievrite.

Let us first suppose that it strikes our senses as belonging to Part I, then its hardness will exclude it from the two first Divisions, and it must consequently be referred to Division III.

Again, recurring to hardness and fusibility, we find that it must belong to Section 1, A, of this Division, or at one view to Part I, Division III, Section 1, A.

Turning to this Part, &c., in the next chapter, we find it described there, and at once easily distinguishable from the other minerals arranged with it, by simply the colour of its streak.

Secondly, let us suppose that from its lustre it appears to us to belong to Part II; then, its hardness excluding it from the first, it can only belong to the second Division of this Part.

We next find that, not being malleable, it is excluded from Section 1 of this Division, but that being attractable by the magnet after exposure to the blow-pipe, and being likewise fusible *per se*, it must belong to Section 2, A, or at one view to Part II, Division II, Section 2, A.

Turning to this Part, &c., in the next chapter, we find that its characters, as there detailed, so easily distinguish it from any other of the few minerals likewise arranged there, as to render farther investigation in this place tedious and unnecessary.

3. Explanation of the few Abbreviations made use of in Chapter II.

C. Colour.

Fr. Fracture.

H. Hardness. The degrees of hardness are expressed in figures, according to the well-constructed and highly useful scale of Professor Mohs.

1. Talc, of a white or greenish colour.
2. Rock-salt, a pure cleavable variety.
3. Calc-spar, a cleavable variety.
4. Fluor-spar, possessing a distinct cleavage.
5. Apatite, the variety named Asparagus stone from Saltzburg.
6. Adularia Felspar.
7. Transparent Rock-crystal.
8. Topaz.
9. Corundum.
10. Diamond.

L. Lustre. The *kinds* of lustre are expressed in words at full length; the *degrees* being of inferior consequence, are often denoted by figures, as under:—

0. Dull.
1. Glimmering.
2. Glistening, or weakly shining.

- 3. Shining.
- 4. Splendent.
- Sk. Streak.*
- Sp. gr. Specific gravity.

T. Transparency ; its degrees are often denoted by figures in the following order :—

- 0. Opaque.
- 1. Translucent on the edges.
- 2. Translucent.
- 3. Semi-transparent.
- 4. Transparent.
- P.F. Primary form.
- O.F. Oxidating flame
- R.F. Reducing flame } as produced by the blow-pipe.
- C.P. Constituent parts.
- P.L. Principal localities.

4. Characteristic Effects of the pure Metallic Oxides on Borax and Soda, as developed by the Action of the Blow-pipe.†

For the sake of easy reference these oxides are arranged in three groups, as follows :—

Group I. Oxides which impart a Colour to one or both of the Fluxes.

OXIDE OF COPPER.

With borax in the O.F. it gives a pure green glass, which loses its colour in the R.F. whilst hot, but on cooling it turns dark red and opaque.

With soda : green glass, which becomes colourless, and opaque when cold.

With both fluxes it is reduced on charcoal.

OXIDE OF IRON.

With borax : red glass, hot ; when cold, yellow, sometimes colourless in the O.F. ; in the R.F., impure green glass, which, on the heat being continued, becomes bottle-green, and bluish-green.

With soda, does not dissolve, but is reduced on charcoal.

OXIDE OF NICKEL.

With borax : orange or reddish yellow glass, which becomes paler or almost colourless on cooling. If a large quantity of the oxide be used, the glass during fusion is dark reddish-brown and opaque, but on cooling it becomes dark red and transparent.

With soda : not dissolved.

* When the colour of the streak is not mentioned, it is white.

† These effects are best shown on a small piece of platina wire, one end of which must be bent upwards into a small hook, to which the moistened flux will adhere.

‡ It may be unnecessary to remind the student that if more than a very small quantity of the oxides be used, the fluxes will generally be so deeply coloured as to appear black and opaque.



OXIDE OF MANGANESE.

With borax in the O.F. : transparent amethyst-coloured glass, which becomes colourless in the R.F. If a large quantity of the oxide be used the glass will recover its colour, unless it be cooled rapidly by being plunged into cold water, &c.

With soda : green glass, more or less deep ; when cold, bluish-green, or almost blue, and enamel-like.

OXIDE OF COBALT.

With borax : transparent deep blue glass, which does not become opaque by flaming.*

With soda a small quantity only is dissolved ; by transmitted light the fused portion is pale red ; when cold it is of a grey or pale reddish-grey colour.

OXIDE OF MOLYBDENUM (Molybdic Acid).

With borax in the O.F. : transparent colourless glass ; in the R.F., if in small quantity, the glass remains colourless or takes a faint brown tinge ; but if in large proportion it turns greyish-black and opaque.

With soda in O.F. : colourless glass, opaque on cooling ; in the R.F. it effervesces violently, and gives the following results :— if the oxide be in small proportion, a colourless glass, opaque on cooling ; if in large proportion, a reddish-brown glass, opaque on cooling ; and if in *very large* proportion, a brownish glass, which turns immediately greyish-black and opaque. With microcosmic salt in the R.F. it gives an emerald green glass, which becomes black when saturated.

OXIDE OF TITANIUM (Titanic Acid).

With borax in the O.F. : colourless glass, which turns milk-white by flaming ; in the R.F., after a short time, it gives a dark amethyst-coloured glass. On charcoal, in the R.F., with a large proportion of the oxide, it yields a dark-yellow glass, which, upon cooling, turns dark blue and almost opaque ; by flaming, it becomes quite opaque, and of a light-blue colour.

With soda : dark-yellow glass, which becomes nearly white, and emits numerous and rapid sparks upon cooling ; on charcoal this glass crystallises with the evolution of great heat.

OXIDE OF URANIUM.

With borax in the O.F. it gives a dark-yellow glass, which changes to a dirty green in the R.F. ; with M.S. in the R.F., fine green glass.

With soda it is not dissolved, but a large proportion of the oxide turns the flux yellowish-brown.

OXIDE OF CERIUM.

With borax in the O.F. it yields a fine red or orange-coloured glass, which turns pale yellowish upon cooling ; by flaming it becomes white and opaque, like enamel. In the R.F. it gives a colourless glass.

* Letting the flame of the blow-pipe play upon it in an intermitting manner.

With soda it is not dissolved.

With M.S. : fine red glass, colourless on cooling, and not rendered opaque by flaming.

OXIDE OF CHROMIUM (Chromic Acid).

With borax : fuses in the R.F., with difficulty, into a fine emerald-green glass, which, when exposed to the O.F., turns brownish-yellow whilst hot; and when cold, recovers a faint green tinge.

With soda : yellow glass, opaque when cold; in the R.F., green opaque glass.

OXIDE OF TUNGSTENUM (Tungstic Acid).

With borax in the O.F. : clear colourless glass, which is not rendered opaque by flaming; in the R.F., with a small proportion of the oxide, yellow glass, when cold; but if the oxide be in large proportion, the glass, on cooling, takes a fine red colour.

With microcosmic salt in the R.F. it gives a fine blue glass, but if it contain iron, as in the Wolfram, &c., the glass takes a deep red colour. Tin dispels this colour, and imparts a green or bluish tint to the glass, if it be not too deeply saturated.

With soda : dark-yellow glass, white or yellowish when cold.

OXIDE OF LEAD.

With borax : whilst hot, a yellow glass, which becomes colourless on cooling.

With soda : colourless glass; on cooling it becomes yellowish and opaque.

On charcoal it is instantly reduced with both fluxes.

Group II. Oxides which do not impart a Colour to the Fluxes, but which, when fused with Borax, yield a permanently clear Glass, not turning opaque when flamed.

SILICA.

With borax : fuses, with difficulty, into a clear glass.

With soda : yields the same result, but easily and with great effervescence.

With microcosmic salt it dissolves only in small part; the glass, when cold, is transparent, and holds, in its centre, a tumefied mass or skeleton of undissolved silica.

ALUMINA.

With borax : yields slowly a clear glass.

With soda : swells up into an infusible mass.

With microcosmic salt : a permanently clear glass.

OXIDE OF TIN.

With borax and M.S. : fuses, with difficulty, into a clear glass.

With soda it forms an infusible mass on the platina wire, but is easily reduced to the metallic state on charcoal.

Group III. Oxides which do not impart a Colour to the Fluxes, but which, when fused with Borax, yield a Glass that turns milk-white and opaque by flaming.

OXIDE OF COLUMBIUM (Columbic Acid).

With borax : transparent colourless glass, which, when flamed, turns opaque and enamel-white if in large proportion.

With soda : effervesces, but is infusible.

With microcosmic salt it gives a colourless glass, which cannot be made opaque by flaming.

OXIDE OF ZINC.

With borax and microcosmic salt : fuses easily into a clear glass, which becomes milky by flaming.

With soda on the platina wire it is infusible, but on charcoal it is reduced and volatilized, covering the support with white fumes.

OXIDE OF CADMIUM.

With borax and M.S. : yellowish glass when hot ; when cold, colourless ; the saturated solution is rendered milk-white and opaque by flaming.

With soda : infusible.

On charcoal, with either flux, it is reduced and volatilized, covering the support with yellow fumes.

OXIDE OF ZIRCONIUM (Zirconia).

OXIDE OF YTTRIUM (Yttria).

OXIDE OF GLUCINIUM (Glucina).

With borax and microcosmic salt : fuse easily into a clear glass, which becomes milk-white by flaming.

With soda these oxides are infusible.

OXIDES OF CALCIUM (Lime), MAGNESIUM (Magnesia), STRONTIUM (Strontia), and BARIUM (Baryta).

With borax and microcosmic salt : fuse into a clear glass, which is rendered opaque by flaming.

With soda : not dissolved.

NOTES.

1. Potassa, soda, and lithia also yield, with borax, a glass, which turns opaque on cooling, or by flaming.
2. For the action of the oxides of antimony, arsenic, and bismuth on the fluxes, the reader is referred to their respective descriptions in the following chapter.
3. The oxides of tellurium, gold, silver, platinum, osmium, iridium, rhodium, and mercury, do not occur in nature.
4. As sulphur occurs so frequently in nature as a mineralizer, either alone forming *sulphurets*, or in the state of sulphuric acid, when mineralized by oxygen, forming *sulphates*, it may be of service to the student to point out some simple methods of recognising these compounds by the aid of the blow-pipe.*
Sulphurets may always be detected by the sulphureous odours which they give out when roasted on charcoal, unless they be combined with volatilizable metals of a more powerful odour, such as arsenic, &c., in which case they may be roasted in an

* See 'The Treatise on the Blow-pipe,' by Berzelius.

open glass tube of small diameter, having, at the upper part, a slip of moistened brazil-wood paper, which will be bleached by the action of the sulphureous fumes; or they may be treated in the following manner, as recommended for the sulphates.

A small quantity of very pure carbonate of soda* and silica (powdered rock-crystal) must be moistened and mixed with a small portion of the suspected sulphate; the whole being then fused into a globule on charcoal or the platina wire, should the assay have contained sulphur or sulphuric acid, it will be made immediately evident, by the globule assuming on cooling a red, orange-yellow, or dark-brownish colour.

It is needless to observe that, should the sulphate contain any metallic oxide, which of itself would impart a colour to soda, the tints produced by the reduction of the sulphuric acid will be lost in those of the oxide.

5. The non-oxidized combinations of selenium (seleniurets) give likewise, with soda and silica, the above results, but they may be easily distinguished from the sulphurets by the powerful odour which they give out before the blow-pipe, resembling decayed horse-radish. This character will likewise distinguish them from the arseniurets, &c., but it should be mentioned that compounds of tellurium (tellurets) occasionally emit the same odour, in consequence of being mixed with a minute portion of selenium.
6. Arsenic and its combinations are known by the alliaceous or garlic-like odour which they give out before the blow-pipe.

The student is referred to the arrangement of minerals in the third chapter, for a detailed account of the characters of the various inorganic combinations which occur in nature, such as the Fluorides, Arseniurets, Silicates, &c.; and it will be advisable for him, after discovering the name of any mineral by the artificial arrangement in the next chapter, to try (as a proof of its correctness) if it agree with the characters described at the head of the natural order or family to which it belongs in Chapter III.

* Carbonate of soda, as purchased at the druggist's, generally contains a portion of sulphate of lime, in which case it would alone, when fused with silica, give indications of sulphur; it should, therefore, always be tried before being used.

CHAPTER II.

An artificial Arrangement of Simple Minerals, with their Descriptions, comprising: (1) Their Distinguishing or Specific Characters; (2) Constituent Parts; and (3) Principal Localities.

PART I.

Division I.

Section 1.

HYDROGEN.

Pure Hydrogen Gas, *M.*; Hydrogène, *Beud.*

This gas rises from beds of limestone and coal in various parts of the world; but it is rarely found pure; Sp. gr. 0.00012; it has a fetid smell; but when perfectly pure is inodorous and highly inflammable.

CARBURETTED HYDROGEN.

Empyreumatic Hydrogen Gas, *M.*; Grizou, *Beud.*

Rises from coal pits, stagnant pools, marshes, and volcanoes; Sp. gr. 0.0008; odour, empyreumatic; inflammable. It is the "fire-damp" of British miners.

C. P. Hydrogen 26.0, carbon 74.0, *Berz.*

SULPHURETTED HYDROGEN.

Sulphuretted Hydrogen Gas, *M.*; Hydrogène Sulfuré, *Beud.*

Rises from sulphureous waters, volcanoes, and marshy places. Sp. gr. 0.00135; strong odour and taste of putrid eggs; inflammable and highly deleterious.

C. P. Hydrogen 5.824, sulphur 94.176, *Berz.*

P. L. Barèges, Moletz, Arles, Baden near Vienna, &c.; likewise in Italy, from volcanic productions, and from swamps and marshes in various parts of the world.

PHOSPHURETTED HYDROGEN.

Phosphuretted Hydrogen Gas, *M.*

Rises from marshes which contain decomposing organic substances; odour of putrid fish; inflammable. This gas is generally considered to form those wandering lights termed "Will of the Wisp," &c.

C. P. Hydrogen and phosphorus.

ATMOSPHERIC AIR.

The atmosphere which surrounds the earth; Sp. gr. 0.001; tasteless and inodorous.

C. P. Nitrogen 79, oxygen 21, generally with minute and variable proportions of carbonic acid.

CARBONIC ACID.

Rises from acidulous springs, marshes, and volcanic productions. Sp. gr. 0.0018; taste slightly acid; fatal to animal life; turns blue vegetable colours for a short time red.

C. P. Carbon 27.40, oxygen 72.60, *Berz.*

P. L. Near Naples, in the celebrated "*Grotta del Cane*," and in mines and marshy places in various parts of the world.

GASEOUS VAR. OF SULPHURIC ACID.

Rises from volcanic rocks ; Sp. gr. 0·0028 ; odour, sulphureous.

C. P. Sulphur 50·144, oxygen 49·856, *Berz.*

HYDRO-CHLORIC ACID.

Rises from volcanoes. Sp. gr. 0·0023 ; odour, pungent ; taste, strongly acid ; fatal to animal life ; turns blue vegetable colours permanently red.

C. P. Hydrochloric acid (which consists of equal volumes of hydrogen and chlorine) 73·31, water 24·69, *Berz.*

Section 2.

WATER. OXIDE OF HYDROGEN.

Sp. gr. 1·0 ; when pure, tasteless and inodorous.

C. P. Oxygen 88·94, hydrogen 11·06, *Berz.*

Note.—Sea water has a mean Sp. gr. of 1·0269, and contains chloride of sodium, chloride of magnesium, sulphate of soda, and chloride of calcium.

LIQUID VAR. OF SULPHURIC ACID.

Sp. gr. 1·85 ; taste, acid and burning. It attracts moisture from the air.

C. P. Sulphuric acid 81·67, water 18·83.

P. L. Italy, Sicily, Java, &c. in the vicinity of volcanoes.

Section 3.

MINERAL OIL.

Id. Phil., M.

Var. 1. Naphtha.

Liquid ; transparent ; C. yellow, white ; burns with a white flame and much smoke, giving out at the same time a penetrating odour.

C. P. Carbon 82·2, hydrogen 14·8, *Thomson.*

P. L. Persia, Sicily, Italy, &c.

Var. 2. Petroleum.

Semi-fluid ; T. 0,2,3 ; C. blackish and reddish-brown ; burns with much smoke, giving out a strongly bituminous odour.

P. L. In rocks of the coal formation in France, England, &c., and near Parma, in Italy.

Note.—The 1st var. often thickens and passes into the 2nd, when exposed to the atmosphere.

Division II.

Section 1.

Remarks.—This section consists almost entirely of *sulphates*, which may be easily known by following the directions given for that purpose at the end of the preceding chapter ;—of *nitrates*, which detonate on charcoal before the blow-pipe, or which, if heated to redness in a small glass tube closed at one end, will fill it with the yellow vapours of nitrous acid ;—and of *chlorides*, which, if mixed with a small quantity of microcosmic salt and oxide of copper, and exposed to the blow-pipe, will impart a deep blue colour to the flame, a character not possessed by other substances when treated in a similar manner.

ALUM.

Id. Phil. ; Alun, Beud. ; Octahedral Alum Salt, M.

Taste, sweetish-astringent ; H.=2·0—2·5 (otherwise it is friable) ;

Sp. gr. 1·7—1·8 ; C. white, grey. It occurs in fibrous masses and dull earthy crusts. P. F. the Octahedron.

Before the blow-pipe it froths up, and is converted into a white spongiform mass.

C. P. Sulphate of alumina 36, sulphate of potassa 18, water 46, *Gmelin*.

P. L. Hurlet near Paisley, Yorkshire, Norway, &c., in schistose argillaceous rocks. Bohemia, with brown-coal. Stromboli, and other volcanoes.

ALUNOGENE.

Id. Beud.; Sulphate of Alumina, *Phil.*

Taste, similar to that of alum; H.=2.0 and less; Sp. gr. 1.6—1.7; C. white, yellowish. In small fibrous and scaly masses, sometimes mamillated. Before the blow-pipe it acts like alum.

C. P. Sulphuric acid 36.4, alumina 16.0, water 46.6, with very minute portions of oxide of iron and lime, *Boussingault*.

P. L. South America (Socono, &c.) in clay-state. Also some of the solfataras of Guadeloupe.

Note.—The fibrous and botryoidal substances known by the names of plumose vitriol (alun de plume, federsalz, &c.) and bergbutter, are merely mixtures of hydrous sulphate of alumina, and melantherite (sulphate of iron oxide.) They are arranged by Beudant as an appendix to the above.

AMONALUM.

Id. Beud.; Sulphate of Alumina and Ammonia, *Phil.*

Taste, bitter; H. about 2.0 (?); C. and Sk. white. It occurs in small fibrous masses.

Before the blow-pipe it acts like common alum. Its aqueous solution gives out an ammoniacal odour, on the addition of a caustic alkali.

C. P. Sulphuric acid 38.58, alumina 12.34, ammonia 4.12, water 44.96, *Lampadius*.

P. L. Tschermig, Bohemia, in lignite.

SODA-ALUM.

Id. Phil.; Alun à base de soude, *Beud.*

H. about 2.0; Sp. gr. 1.88. In small white fibrous nodules, resembling alum in taste, and comportment before the blow-pipe.

C. P. Sulph. acid 38.5, alumina 12.0, soda 7.5, water 42.0, *Thomson*.

P. L. St Juan, S. A., in clay-state. Also the solfataras of Milo.

Note.—The above substances may be distinguished from those which follow, by their aqueous solutions yielding, on the addition of ammonia, a gelatinous precipitate (alumina).

EXANTHALOSE. SULPHATE OF SODA.

Id. (εξανθεω, to effloresce, and αλος, Salt), *Beud.*; Sulphate of Soda, *Phil.*; Prismatic Glauber Salt, *M.*

Taste, cooling, bitter and saline; H.=1.5—2.0, if it be not friable; Sp. gr. 1.4—1.5; C. white, yellowish. It occurs in an efflorescent state, dull and earthy-looking; more rarely in stalactitic and other concretions, with a vitreous lustre in the fracture. P. F. an oblique rhombic prism of 99° 36' and 80° 24'.

Very easily fusible (see Epsomite).

C. P. Sulphuric acid 44.8, soda 35.0, water 20.2, *Beud.*

P. L. The salt mines of Austria, Salzburg, &c. The hot springs of Carlsbad, &c. Also, Vesuvius, on lava.

Appendix.

Thenardite, an anhydrous sulphate of soda, with a minute proportion of subcarbonate of soda. Sp. gr. 2.73; C. white, reddish. It occurs in minute octahedrons with rhombic bases, grouped together, and forming superficial depositions at the bottom of several lakes near Aranjuez, in Spain.

See Beudant's 'Min.' t. ii, p. 474.

EPSOMITE. SULPHATE OF MAGNESIA.

Id. Beud.; Sulphate of Magnesia, *Phil.*; Prismatic Epsom Salt, *M.*

Taste, bitter and saline; $H.=2.0-2.5$ (if not friable); Sp. gr. 1.7—1.8; C. white, grey. It occurs in fibrous concretions, reniform, &c., and in an efflorescent state. P. F. a rhombic prism of $90^{\circ} 30'$ and $89^{\circ} 30'$.

Easily fusible. With soda, on charcoal, it intumesces and forms an infusible mass on the surface of the support, of a yellow or reddish colour, whereas the Exanthalose, if treated in a similar manner, sinks completely into the charcoal. The Epsomite is also precipitated from its aqueous solution, by the same re-agent (carbonate of soda), which has no effect on that of the Exanthalose.

C. P. Sulphuric acid 32.57, magnesia 16.00, water 51.43, *Berz.*

P. L. Epsom, Surrey, and Sedlitz, &c. in Bohemia, in solution in mineral waters. Hurlet near Paisley, Switzerland, &c., on aluminous schists. Montmartre in gypsum, and in old mines in Hungary, Idria, &c.

POLYHALLITE.

Taste, bitter, but very faint; is scarcely acted upon by water; C. red.

See Section 6, A (Group 2), of this Division.

GLAUBERITE.

Id. Beud., Phil.; Prismatic Brythine Salt, *M.*; Brogniartine.

Taste, saline, but feeble; $H.=2.5-3.0$; Sp. gr. 2.75—2.85; C. white, yellow, grey. L. vitreous. It occurs massive, and crystallized in very flat oblique rhombic prisms of $83^{\circ} 20'$ and $96^{\circ} 40'$; inclination of the base on the lateral planes, $104^{\circ} 15'$.

Decrepitates before the blow-pipe, and melts into a white enamel. It is only partly soluble in water, which circumstance, joined to its high Sp. gr., will easily distinguish it from any of the other sulphates of this section.

C. P. Sulphate of lime 49, sulphate of soda 51, *Brogniart.*

P. L. Villa Rubia, Toledo, in Spain, in rock-salt or its accompanying clays. Aussee, in Upper Austria, in the same.

APTHALOSE. SULPHATE OF POTASSA.

Apthalose ($\alpha\phi\theta\iota\tau\omicron\varsigma$, unalterable), *Beud.*; Sulphate of Potassa, *Phil.*; Prismatic Glauber Salt, *M.*

Taste, saline, bitter; $H.=2.5-3.0$, otherwise friable; Sp. gr. 1.731; C. white, yellow sometimes stained green or blue. It occurs in crusts, massive, and in mamillary concretions; and is only found on volcanoes, as Vesuvius, &c.

Fusible *per se* into a globule, which, on cooling, becomes opaque; with soda, on charcoal, it sinks into the support. The artificial crystals decrepitate.

C. P. Sulphate of potassa, with sometimes minute proportions of sulphate and chloride of copper.

JOHANNITE. SULPHATE OF URANIUM.

Johannite, *Haid., Phil.*; Uran Vitriol, *John.*

Taste, slightly bitter; $H.=2.0-2.5$, or friable; Sp. gr. 3.15—3.2; C. deep green; Sk. very pale green. It occurs in needle-like crystals, of which the primary form, according to Haidinger, is an oblique rhombic prism.

It is only partly soluble in water. Fusible *per se*; gives in the R. F. a bead of copper. With the fluxes it develops the action of uranium and copper.

C. P. Sulphuric acid, water, and the oxides of uranium and copper in unknown proportions.

It has hitherto only been found in a vein traversing mica-schist, at Joachimsthal, in Bohemia, and is very rare.

GALLITZINITE. SULPHATE OF ZINC.

Sulphate of Zinc, *Phil.*; Prismatic Vitriol Salt, *M.*; White Vitriol; Gallitzinite, *Beud.*

Taste, nauseous and metallic; $H.=2.0-2.5$; Sp. gr. $2.0-2.1$; C. greyish-, greenish-, yellowish-, or reddish-white; Sk. white; L. vitreous. It occurs massive, in fibrous and botryoidal concretions, stalactitic, and rarely in minute six-sided crystals. It is likewise sometimes found in friable coatings. P. F. a right-rhombic prism of $90^{\circ} 42'$.

Before the blow-pipe it fuses with ebullition on charcoal, covering the support with the white oxide of zinc, which is more strongly shown if fused with soda.

C. P. Sulphuric acid 26, oxide of zinc 28, water 46.

P. L. Flintshire, Cornwall, with blende; the Hartz, Hungary, &c. It is a rare mineral, and is generally mixed with the following.

CYANHALOSE. SULPHATE OF COPPER.

Cyanose, *Beud.*; Tetarto-prismatic Vitriol Salt, *M.*; Blue Vitriol.

Taste, nauseous, metallic; $H.=2.5$; Sp. gr. $2.2-2.3$; C. blue, bluish-green; Sk. white; T. 2—4. It occurs massive, stalactitic, &c., and dissolved in water issuing from mines.

Before the blow-pipe, *per se*, on charcoal, it effervesces, and is converted into a greyish and brittle scoria. With the fluxes the effects of copper are developed. It is precipitated from its aqueous solution on a polished surface of iron.

C. P. Oxide of copper 32.13, sulphuric acid 31.57, water 36.30, *Berz.*

P. L. Pary's mine, Anglesea; Cornwall, the Hartz, Sweden, Hungary, &c., in copper mines.

MELANTHERITE. SULPHATE OF IRON.

Green Vitriol; Sulphate of Iron, *Phil.*; Hemi-prismatic Vitriol Salt, *M.*; Melantherie, *Beud.*

Taste, nauseous and metallic, resembling that of ink; $H.=2.0$, and less; Sp. gr. $1.8-1.9$; C. green, often yellowish externally; Sk. white. It occurs massive, stalactitic, often in an earthy state, and rarely crystallised. P. F. an oblong rhombic prism of $99^{\circ} 23'$.

Before the blow-pipe it intumesces, and is converted into a greyish-black, brittle, and magnetic scoria. With borax it produces the reactions of iron.

C. P. Sulphuric acid 28.8, protoxide of iron 25.7, water 45.4, *Berz.*

P. L. Hurler near Paisley, Goslar in the Hartz, Saxony, &c. It arises chiefly from the decomposition of iron-pyrites.

BOTRYOGENE.

Id. Allan; Neoprase, *Beud.*

Taste, slightly astringent and metallic; $H.=2.0-2.5$; Sp. gr. $2.0-2.1$; C. red, reddish-yellow; Sk. yellow; T. 2. It occurs in small crystals aggregated in botryoidal concretions; also massive, in the form of crusts, &c. P. F. an oblique rhombic prism of $119^{\circ} 66'$.

Before the blow-pipe it effervesces, and leaves a reddish-yellow scoria. It is only partly soluble in water.

C. P. Sulphuric acid 32·58, peroxide of iron 23·86, protoxide of iron 10·71, water 32·85, *Berz.*

P. L. The copper mine of Fahlun in Sweden, with gypsum, iron-pyrites, green vitriol, &c.

Note.—A pulverulent persulphate of iron, of a yellow colour, named *Misy*, occurs at Goslar in the Hartz, and, with Botryogene, at Fahlun. At Goslar it is associated with another variety of sulphate of iron, of a brick-red colour, and compact, to which the name of *ATTRAMENT STONE* has been given.

RHODALOSE. SULPHATE OF COBALT.

Id. Beud.; Sulp. of Cobalt, *Phil.*; Red Vitriol.

Taste, astringent; friable; C. red, reddish-white; Sk. yellowish-white. It occurs in crusts, stalactitic, and in small crystalline masses. P. F. an oblique rhombic prism of $97^{\circ} 35'$.

Before the blow-pipe it colours borax deep blue, which will alone serve to distinguish it from any other mineral substance of this section. Solution in nitric acid, rose-red.

C. P. Sulphuric acid 30·2, oxide of cobalt 28·7, water 41·2, *Beud.*

P. L. Bieber near Hanau, with heavy-spar and ores of cobalt; Lergang, Salzburg.

MASCAGNINE. SULPHATE OF AMMONIA.

Id. Phil.; *Id. Karsten.*

Taste, bitter and sharp; friable; C. yellow, greyish-yellow; Sk. white. It occurs in mealy crusts, also stalactitic: it becomes moist when exposed to the air.

Before the blow-pipe it is volatilized. When mixed with a small quantity of soda or potassa it emits a strong ammoniacal odour.

C. P. Ammonia 22·80, sulphuric acid, 53·29, water 23·91, *Gmelin.*

P. L. The lavas of Etna and Vesuvius.

NITRE. NITRATE OF POTASSA.

Nitrate of Potash, *Phil.*; Prismatic Nitre Salt; Saltpetre.

Taste, cooling and saline; H.=2·0 if pure; Sp. gr. 1·9—2·0; C. white, yellowish; Sk. white. It occurs in capillary crystals, fibrous concretions, and in friable crusts. P. F. a rhombic prism of 120° .

Before the blow-pipe it fuses, but detonates at the same instant, leaving an alkaline mass on the charcoal.

C. P. Potassa 55·28, nitric acid 44·72.

P. L. Egypt, Arabia, Hindostan, Hungary, Spain, Italy, on the surface of plains, and in limestone caves.

NITRATE OF SODA.

Id. Phil.; Zootinsalz, *Breithaupt.*

Taste, cooling and bitter; H.=1·5—2·0, or friable; Sp. gr. 2·0—2·1; C. and Sk. white, when pure. It occurs in mealy crusts, acicular crystals, and massive, often mixed with clay and sand; it is deliquescent.

Before the blow-pipe it fuses, detonates, and sinks into the charcoal.

C. P. Soda 37·2, nitric acid 62·8, *Gmelin.*

P. L. It is said to occur in the district of Tarapaca, Peru, forming a vast bed several feet thick; also near Cadiz, in Spain.

NITRATE OF LIME.

Id. Phil.; Nitrate de Chaux, *Beud.*

Taste, bitter and slightly acid; C. white. It occurs upon the walls of cellars, in damp uninhabited places, and likewise in limestone caverns, in long radiated concretions resembling feathers; deliquescent.

On charcoal it fuses slowly, detonating very slightly.

C. P. Lime 33·8, nitric acid 66·2, *Wenzel*.

NITRATE OF MAGNESIA.

Id. Phil.; Nitrate de Magnesie, *Beud.*

Taste, bitter; C. white. Occurs, in a deliquescent state, in the same situations as Nitrate of Lime, with which it is usually accompanied.

C. P. Magnesia 28, nitric acid 72, *Wenzel*.

NATRON. CARBONATE OF SODA.

Id. Phil.; Prismatic Natron Salt, *M. J.*; Natron, *Beud.*; Naturalisches Mineral-Alkali, *W.*

Taste, pungent and alkaline; it effervesces briskly in acids; H.=1·0—1·5; Sp. gr. 1·4—1·6; C. white, greyish, or yellow. It occurs in acicular crystals, radiated concretions, and earthy crusts; it is sectile; deliquescent.

Before the blow-pipe it dissolves, and sinks into the charcoal.

C. P. Soda 50·2, carbonic acid 35·1, water 14·7; from Hungary, *Beud.* The Egyptian natron contains a proportion of sulphate of soda.

P. L. Hungary, in efflorescences on the plains of Debretzin; Bohemia; Egypt.

TRONA. SESQUI-CARBONATE OF SODA.

Id. Phil.; Hemi-prismatic Natron Salt, *M.*; Urao, *Beud.*

Taste, pungent and alkaline; effervesces briskly in acids; H.=2·5—2·75 when pure; Sp. gr. 2·112; C. white or grey. It occurs massive, in fibrous concretions and indistinct crystalline groups; it is rather brittle, and not deliquescent.

Before the blow-pipe it comports itself like natron.

C. P. Soda 37·43, carbonic acid 39·27, water 23·28, *Beud.*

P. L. Sukena, Egypt; Barbary; South America.

SASSOLINE. BORACIC ACID.

Sassoline, *Beud.*; Native Boracic Acid, *Phil.*; Prismatic Boracic Acid, *M.*

Taste, slightly acid, afterwards bitter and cooling, and lastly sweetish; friable; Sp. gr. 1·4—1·5; C. white, greyish, yellowish. It occurs in scaly crusts and crystalline particles of a pearly lustre.

Fusible in the flame of a candle into a clear glass, and imparting to alcohol the property of burning with a green flame.

C. P. Boracic acid 56·37, water 43·63, *Beud.*

P. L. The hot springs of Sasso, and certain lakes, in Tuscany. The crater of Volcano, one of the Lipari Isles.

BORAX. BORATE OF SODA.

Id. Phil.; Prismatic Borax Salt, *M.*; Tincal.

Taste, feebly sweetish and alkaline; H.=2·0—2·5; Sp. gr. 1·7—1·8;

C. white, grey, greenish; In. L. resinous. It occurs in flattish hexahedral prisms with oblique summits, of which the primary form is an oblique rhombic prism of 86° 30' and 93° 30'.

Before the blow-pipe it intumesces violently, and melts into a transparent globule.

C. P. Soda 14·50, boracic acid 14·50, water 47·0, *Klapr.*

P. L. Thibet, Persia, China, Peru; on the surface of the soil, and at the bottom of certain lakes.

The crystals are usually covered with an opaque earthy crust.

ARSENIC ACID.

Oxide of Arsenic, *Phil.*; Octahedral Arsenic Acid, *M.*; Acide Arsenieux *Beud.*

Taste, sweetish-astringent; $H.=1.5$, or less; Sp. gr. $3.6-3.71$;

C. white, yellowish-white; L. vitreo-adamantine. It occurs in delicate capillary crystals, reniform, stalactitic, and in crusts or coatings, which have often a pearly lustre.

Before the blow-pipe, on charcoal, it is volatilized with a strong alliaceous odour.

C. P. Arsenic 75.82, oxygen 24.19, *Berz.*

P. L. Andreasberg, Hartz; Joachimsthal; Bohemia; with ores of arsenic, silver, &c.

ROCK SALT (CHLORIDE OF SODIUM).

Muriate of Soda, *Phil.*; Hexahedral Rock Salt, *M.*; Sal Mare, *Beud.*

Taste, strongly saline; $H.=2.0$; Sp. gr. $2.2-2.3$; C. grey, white, red, blue, green, &c.; Sk. white; L. vitreous, vitreo-resinous.

It occurs massive, stalactitic, in radiated and fibrous concretions, &c., and cleaves easily, when pure, in the direction of its primary form, the cube.

Before the blow-pipe it generally decrepitates, and melts easily into a clear glass, which spreads over the support, and, if on charcoal, sinks into it.

C. P. Chlorine 60.34, sodium 39.66, if perfectly pure, *Beud.*

P. L. Cheshire; Wieliczka, Poland; Hall, in the Tyrol; Austria; Salzburg; Spain; Egypt, &c., chiefly in secondary rocks.

SAL AMMONIAC.

Muriate of Ammonia, *Phil.*; Octahedral Ammoniac Salt, *M.*; Salmiak, *Beud.*

Taste, pungent and urinous; $H.=1.5-2.0$, or friable; Sp. gr.

$1.5-1.6$; C. white, grey, yellow, sometimes stained green or black; Sk. white; sectile. It occurs massive, in fibrous concretions, stalactitic, botryoidal, in mealy crusts, &c.; it does not attract moisture from the air.

Before the blow-pipe it is entirely volatilized; and if moistened and triturated with lime, it emits a pungent ammoniacal odour.

C. P. Hydro-chloric acid 67.97, ammonia 32.03, *Beud.*

P. L. Etna, Vesuvius, the Solfatara near Naples, in cracks and fissures; also in the vicinity of Newcastle, in Scotland, France, &c., near ignited coal-seams.

COTUNNITE. CHLORIDE OF LEAD FROM VESUVIUS.

Cotunnite, *Phil.*, 4th ed. ('Allan's Manual'); Cotunnia, *Monticelli* and *Covelli*.

H. about 1.5 ; C. white. It occurs in very minute acicular crystals, of a somewhat pearly lustre.

Before the blow-pipe it fuses easily, and, with soda, yields globules of lead.

Soluble in about twenty-seven times its weight of cold water.

C. P. Chlorine 25.48, lead 74.52, *Berz.*

L. Vesuvius, with chloride and sulphate of copper, &c.

SECTION 2.

Remarks.—The minerals of this Section are arranged for convenience in two groups: the first of which is composed of those substances which are reducible alone, or with borax, to the metallic state; whilst the second comprises the remaining minerals, or those which are not reducible to the metallic state, either alone or with the fluxes.

In both instances, the individuals generally follow each other according to their specific gravities—the heaviest substances being placed first.

Note.—Those minerals which, by their very feeble effervescence, might cause some doubt in the student's mind as to whether they belonged to this Section or not, are likewise arranged in the other Sections of this work, to which they would be referred if their effervescence were not taken notice of; so that no chance of error can possibly arise, from his considering them as effervescent in acids, or not.*

Group I.

LEAD-SPAR. CARBONATE OF LEAD.

Carbonate of Lead, *Phil.*; Diprismatic Lead Baryte, *M.*; White Lead Ore; Ceruse, *Beud.*

Effervesces generally briskly; $H.=3.0-3.5$, otherwise it is friable; Sp. gr. $6.3-6.6$; C. white, grey, greyish-black, also stained yellow, green, &c.; Sk. white; L. adamantine-resinous; very brittle. It occurs massive, cellular, and crystallized. (Fig. 173, 174, 176, 161*a*, 189, and 194.) Primary form, a right rhombic prism of $117^{\circ} 0'$ and $63^{\circ} 0'$. It likewise occurs in an earthy state. Before the blow-pipe it decrepitates, becomes yellow, then red, and is immediately reduced to the metallic state.

C. P. Protoxide of lead 82, carbonic acid 16, water 2, *Klapr.*

P. L. Leadhills and Wanlockhead in Scotland, with sulphate and phosphate of lead, &c.; St Minver's mine, Cornwall, in delicate acicular crystals; Cumberland; Saxony; the Hartz; Siberia, Bohemia, &c., chiefly with galena.

LEADHILLITE. SULPHATO-TRI-CARBONATE OF LEAD.

Id. Beud., Phil., Brooke—Suzannite.

Effervesces briskly, leaving a residuum of sulphate of lead; $H.=2.5$; Sp. gr. $6.2-6.4$; C. yellowish, grey, green; Sk. white; L. adamantine-resinous, pearly. It occurs massive and crystallized. Primary form, an oblique rhombic prism of $120^{\circ} 0'$ and $59^{\circ} 40'$, according to Haidinger.

Before the blow-pipe it decrepitates, and is reduced in the R. F.; with soda and silica it acts as a sulphate.

C. P. Carbonate of lead 71.1, sulphate of lead 30.0, *Berz.*

P. L. Leadhills, Scotland, with lead-spar, &c.

LANARKITE. SULPHATO-CARBONATE OF LEAD.

Id. Beud., Phil., Brooke.

Effervescence scarcely perceptible; Sp. gr. $6.7-7.0$. See Sec. 6, A, of this Division.

CALEDONITE. CUPREOUS SULPHATO-CARBONATE OF LEAD.

Id. Beud., Phil., Brooke.

Effervesces very feebly; Sp. gr. 6.4 ; C. green, or bluish-green. See Sec. 6, A, of this Division.

* Every substance comprised in this Section effervesces sensibly in heated acids.

CARBONATE OF BISMUTH.

Partly the Bismuth Ochre of Mineralogists.

Effervesces briskly ; water causes a white precipitate from its solution in nitric acid ; friable ; Sp. gr. 4·31 (?), 4·36 (?) ; C. yellowish, grey. It occurs in earthy crusts and coatings on other minerals.

Reducible and volatilizable before the blow-pipe.

C. P. Oxide of bismuth, carbonic acid, with small proportions of oxide of iron, alumina, water, &c.

P. L. St Agnes, in Cornwall.

RUBERITE.

Red Oxide of Copper, *Phil.* ; Octahedral Copper Ore, *M.* ; Cuivre Oxydulé, *H.* ; Zigueine, *Beud.* ; Rothkupfererz, *W.*

Effervesces briskly in nitric acid, tinging the solution green or bluish, but in muriatic acid it does not effervesce. Sk. dark red.

See Sec. 6, B, of this Division.

CARBONATE OF COPPER.

This carbonate is divided into two species possessing different primary forms, but agreeing closely in chemical composition.

(1) CUPRAZURITE, OR BLUE CARBONATE OF COPPER.

Blue Carbonate of Copper *Phil.* ; Prismatic Azure Malachite, *M.* ; Kupferlazur, *W.* ; Azurite, *Beud.*

Effervesces briskly ; H.=3·5—4·0 ; Sp. gr. 3·5—3·85 ; C. blue, blackish-blue ; Sk. pale-blue ; L. vitreo-adamantine, vitreous ; or vitreo-resinous. It occurs massive, globular, stalactitic, in radiated concretions, &c., and crystallized. (Fig. 204 to 210.)

Primary form, an oblique rhombic prism of $98^{\circ} 50'$, and $81^{\circ} 10'$.

It also occurs in an earthy friable state. Before the blow-pipe on charcoal it fuses, and is easily reduced. It colours the fluxes like oxide of copper.

C.P. Dentoxide of copper 69·08, carbonic acid 25·46, water 5·46, *Phillips.*

(2) MALACHITE, OR GREEN CARBONATE OF COPPER.

Id. Phil. ; Hemi-prismatic Habroneme Malachite, *M.* ; Malachite, *W.*

Effervesces briskly ; H.=3·5—4·0 ; Sp. gr. 3·5—3·75 ; C. green ; Sk. pale green ; L. adamantine, but more commonly silky. It occurs massive, botryoidal reniform, stalactitic, in fibrous and radiated concretions, &c., and very rarely in minute twin crystals, of which the primary form is a right oblique-angled prism.

It occurs also in an earthy state. Before the blow-pipe alone and with the fluxes it behaves like the preceding.

C. P. Deutoxide of copper 70·10, carbonic acid 20·25, water 8·65, *Vaug.*

P. L. of both species. Siberia ; Moldawa in the Bannat ; Chessy, France ; Cornwall, Cumberland, &c.

Group II.

SMITHSONITE, OR ZINC-SPAR. CARBONATE OF ZINC.

Carbonate of Zinc, *Phil.* ; Rhombohedral Zinc Baryte, *M.* ; Rhombohedral Calamine, *J.* ; Galmei (in part), *W.*, *Karsten* ; Smithsonite, *Beud.*

Effervesces briskly ; H.=5·0 if not decomposed ; Sp. gr. 4·2—4·5 ; C. grey, white, and yellow, likewise green and brown ; Sk. white ;

L. vitreo-pearly. It occurs massive, botryoidal, stalactitic, cellular, in radiated and curved-lamellar concretions, and also crystallized in rhombs and long four-sided tables, variously mo-

dified. Primary form, a rhombohedron of $107^{\circ} 40'$, or according to some, of 110° nearly. Before the blow-pipe it is infusible, but loses its carbonic acid, and acts like oxide of zinc with the fluxes.

C. P. Oxide of zinc 65.2, carbonate acid 34.8, *Smithson*.

P. L. Derbyshire, Somersetshire, Cumberland; Leadhills and Wanlockhead, in Scotland; Aix-la-Chapelle; Siberia; Hungary, &c., chiefly in secondary Rocks.

Note.—An earthy and pulverulent or very soft variety of carbonate of zinc, containing about 20 per cent. of water, occurs at Bleiberg, in Carinthia. It is classed by Beudant as a distinct species, under the name of Zinc-onise, and its analysis fully justifies the distinction.

C. P. Carbonic acid 13, oxide of zinc 67, water 20 (at least), *Berthier*. It is the "Hydrous Dicarbonate of Zinc" of Dr Thomson.

WITHERITE, CARBONATE OF BARYTA.

Id. Phil.; Diprismatic Hal-Baryte, *M*.

Effervesces feebly; $H.=3.0-3.5$; Sp. gr. $4.2-4.4$; C. yellowish-white, yellow, grey; Sk. white; L. vitreo-resinous. It occurs massive, in globular and radiated concretions, stalactitic, &c., and crystallized. (Fig. 161 *a*, 161 *b*.)

It is easily fusible *per se* into a white enamel.

C. P. Baryta 22.5, carbonic acid 77.1, lime 0.4, *Beud*.

P. L. Anglesark, Lancashire; Cumberland; Siberia; Sicily; with galena, &c., chiefly in secondary rocks.

BARYTO-CALCITE.

Id. Phil., *Brooke*; Hemi-prismatic Hal-Baryte.

Effervesces briskly; $H.=4.0$, when not decomposed; Sp. gr. $3.6-3.7$; C. white, yellow, grey; Sk. white; L. vitreo-resinous. It occurs massive and crystallized (fig. 214 *a*). Primary form, an oblique rhombic prism of $106^{\circ} 54'$, and $73^{\circ} 6'$. Infusible alone, becoming white and opaque; with the fluxes it acts like lime or baryta, but occasionally gives faint indications of manganese.

C. P. Carbonate of baryta 65.9, carbonate of lime 33.6, *Children*.

It has at present only been found at Alston Moor in Cumberland.

STRONTIANITE, CARBONATE OF STRONTIA.

Strontites, *Phil.*; Strontianite, *B.*; Peritomous Hal-Baryte, *M.*; Strontian, *W*.

Effervesces briskly; $H.=3.5$; Sp. gr. $3.6-3.8$; C. green, grey, brown; Sk. white; L. vitreo-pearly. It occurs in fibrous concretions, generally radiated, and in flattish six-sided crystals, modified on the lateral planes. Primary form, a right-rhombic prism of $107^{\circ} 32'$, or $117^{\circ} 19'$.

Before the blow-pipe it intumesces into a ramified opaque white mass, but fuses only on the surface. This ramified mass glows with an intensely bright light, and imparts a purplish-red colour to the flame, if the heat be well kept up.

C. P. Carbonic acid 30.31, strontia 65.60, lime 3.47, *Strom*.

P. L. Strontian, Argyleshire; Yorkshire; Leogang, in Saltzburg; Braunsdorf, Saxony.

Note.—A carbonate of Strontia mixed with a considerable proportion of sulphate of baryta is said to occur massive, of a greyish or yellowish-white colour, infusible, and possessing a Sp. gr. equal to 3.7, at Stromness, in Orkney. It has been named Stromnite and Barystrontianite.

SIDEROSE, OR IRON-SPAR. CARBONATE OF IRON.

Effervesces very feebly; Sp. gr. 3·6—3·8; magnetic after roasting; infusible. See Sec. 7, A, of this Division (Group 3).

MANGANESE SPAR. CARBONATE OF MANGANESE.

Id. Phil.; Macrotypous Parachrose Baryte, *M.*; Rhombohedral Red Manganese, *J.*; Rother Braunstein, *W.*; Diallogite, *Beud.*

Effervesces rather feebly; H.=3·5; Sp. gr. 3·3—3·6; C. rose-red (sometimes very pale), and brownish; Sk. white; L. pearly; T. 1, 2. It occurs massive, globular, and in radiated fibrous concretions. Primary form, a rhombohedron of $106^{\circ} 51'$, Mohs, 103° Beudant.

Before the blow-pipe it decrepitates violently, and turns black, but is infusible. To the fluxes it communicates in an intense degree the colours of Manganese.

C. P. Oxide of manganese 56·0, carbonic acid 38·6, lime 5·4, from Nagyag, *Berthier*.

P. L. Freiberg, Saxony; Kapnic and Nagyag in Transylvania; with quartz, iron, and copper pyrites, ores of lead and silver, &c., in metalliferous veins.

BREUNNERITE. CARBONATE OF MAGNESIA AND IRON.

Effervesces very feebly; Sp. gr. 3·0—3·2; H.=4·0—4·5; infusible; primary form a rhomb of $107^{\circ} 22'$. See Sec. 7, A, of this Division.

ANKERITE.

Id. Phil.; Paratamous Lime Haloide, *M.*

Effervesces briskly; H.=3·5—4·0; Sp. gr. 2·95—3·1; C. white, grey, brown, reddish; Sk. white; L. vitreous, pearly-vitreous. It occurs massive, in crystalline aggregations, and in rhombic crystals; primary form a rhomb of $106^{\circ} 12'$.

Infusible alone, but blackens and attracts the magnet. With borax, effects of iron.

C. P. Carbonic acid with oxide of iron 35·31, lime 50·11, magnesia 11·85, oxide of manganese 3·08.

P. L. Eisenerz, Styria; Rathhausberg in Salzburg, with iron-spar, &c.

MAGNESO-CALCITE.

Macrotypous Lime Haloide, *M.*; Dolomic, *Beud.*; Bitter-spar, *Phil.*; Magnesian-limestone. See also Sec. 7, A, of this Division.

Effervesces feebly, and very feebly; H.=3·5—4·0; Sp. gr. 2·8—2·95; C. white, grey, brown, red, green; Sk. white. It occurs massive, globular, stalactitic, in prismatic concretions, and crystallized in rhombs; primary form, a rhomb of $106^{\circ} 15'$. Before the blow-pipe it is infusible, *per se*, but generally blackens, and some varieties impart the colours of iron to borax, and faint tints of manganese to soda.

C. P.	Brown-spar.	Miemite.
Carbonate of lime . . .	68·0 . . .	53·0
„ of magnesia . . .	25·5 . . .	42·5
„ of iron . . .	3·0 . . .	3·0
Oxide of iron with oxide of manganese . . .	3·0 . . .	0·0
Water . . .	2·0 . . .	0·0

Klaproth.

Klaproth.

Note.—It has been divided into the following varieties:—Brown-spar or Pearl-spar: of a brown, red, or grey colour, with a more or less pearly lustre, and crystallized, from Freyberg in Saxony; Hungary; the Hartz; Devonshire, Derbyshire, &c.



Dolomite, or Magnesian Limestone: of a white, yellowish-brown, or grey colour, and massive (of a slaty or fine granular structure), forming beds or rocks in the Pyrenees, France, Saxony, &c., as well as in Nottinghamshire, Yorkshire, and other counties in England.

Miomite: of a green or greenish-white colour, massive in prismatic concretions, and crystallized, from Miemo, Tuscany.

Gurhofite: of a snow-white colour, massive, compact, and dull, from the vicinity of Gurhof, in Lower Austria, forming veins in serpentine.

Conite: of a flesh-red colour; massive, in crusts, dull and opaque, from Iceland, Hessa, and Saxony.

MAGNESITE. CARBONATE OF MAGNESIA.

Id. Phil.; Magnesite, *J.*; Globertite (in part), *Beud.*

Effervesces feebly; $H.=3.5$, but it usually yields externally to the nail; Sp. gr. $2.6-2.9$; C. white, grey, yellow, often with brown markings; Sk. white; opaque; dull. It occurs massive, tuberoso, reniform, and vesicular; it adheres to the tongue. Before the blow-pipe it is infusible, but contracts and hardens.

C. P. Magnesia 47.88, carbonic acid 51.82, *Strom.*

P. L. Styria, at Gulsen; Moravia; Italy, at Baldissero and Castellamonte; Baumgarten, Silesia; Spain; North America.

ARRAGONITE.

Id. Phil.; Prismatic Lime Haloide, *M.*; Arragon, *W.*; Prismatic Limestone, *J.*; Flos-ferri.

Effervesces briskly; $H.=3.5-4.0$; Sp. gr. $2.6-3.0$; C. white, grey, yellow, violet-blue, reddish, green; Sk. white; L. vitreous, inclining to resinous, also silky. It occurs massive, globular, coralloidal, in fibrous and prismatic concretions, and crystallized, often in macles (fig. 179, 180, 261, 262). Primary form, a right rhombic prism of $116^{\circ} 5'$ and $63^{\circ} 55'$; infusible *per se*.

If a small fragment of a crystal be held in the flame of a candle it will decrepitate gently, without noise, becoming at the same time of an opaque white colour, and friable. The uncrystallized varieties do not generally decrepitate, but turn immediately white and opaque.

This will perfectly distinguish arragonite from calc-spar, as fragments of the latter either decrepitate violently, or remain unchanged, at least for a considerable time, whereas arragonite turns *immediately* opaque and friable.

C. P. Carbonate of lime 94.82, carbonate of strontia 4.08, water 0.98, *Strom.*

P. L. Arragon in Spain; Bilin in Bohemia; Eisenerz, Styria; Devonshire; Leadhills, in Scotland, &c.

Note.—The coralloidal varieties chiefly from Eisenerz, the Tyrol, &c., were formerly known by the name of *Flos-ferri*.

CALCITE. CARBONATE OF LIME.

Carbonate of Lime, *Phil.*; Rhombohedral Lime Haloide, *M.*; Rhombohedral Limestone, *J.*; Calc-spar, &c.

Effervesces briskly; $H.=3.0$ and under; Sp. gr. $2.5-2.8$; of all colours; Sk. white; primary form, a rhombohedron of $105^{\circ} 5'$, into which it readily cleaves; infusible *per se*, except those impure argillaceous varieties termed marls, which, being only mechanical mixtures of clay, &c., with carbonate of lime, cannot be described as simple minerals.

C. P. of the purest variety of transparent calcite; lime 56.15, carbonic acid 43.70, *Stromeyer*.

The following varieties may be enumerated :—

Transparent or Crystalline Calcite (Calcareous Spar). $H.=3.0$; of all colours, chiefly white or grey; transparent, translucent; doubly refractive. It occurs massive, &c. (possessing a crystalline structure), and crystallized, (fig. 64 to 137).

P. L. Derbyshire; Cumberland; Andreasberg in the Hartz, &c., &c.

Slate-Spar (Schiefer-spath, *W.*). $H.=3.0$; C. white; L. pearly. Occurs massive, and in lamellar concretions, which are often very thin and intersect each other; it sometimes feels slightly greasy.

P. L. Glen Tilt, Perthshire; Ireland; Norway.

Granular Limestone (Marble). $H.=3.0$; of all colours, chiefly white, and often veined, &c.; more or less translucent. Occurs massive, in granular concretions. During calcination it does not preserve its shape like the following variety, but falls to pieces. It occurs in beds amongst primitive rocks in England and various other countries.

Compact Limestone. $H.=3.0$; of all colours, often veined, spotted, &c.; T. 2, 1. Occurs massive, of a more or less compact texture, often forming the substance of petrifications; fracture, splintery, or conchoidal. It occurs in beds, &c., and forming mountains in various countries; it belongs to secondary formations, and is sometimes polished and employed as a marble.

Oolite (Roestone). $H.=2.5-3.0$; it occurs in small globular concretions of a brown or grey colour, under the same circumstances as the above.

Fibrous Limestone (Satin Spar). $H.=3.0$; C. chiefly white or greyish; L. silky, satin-like, chatoyant. It occurs in parallel fibrous concretions, in thin veins in shale, at Dufton.

Stalactitic Limestone (Calc-sinter). $H.=3.0$; C. yellowish-white, &c. It occurs in stalactitic, reniform, and other shapes, composed of lamellar or stellular-fibrous concretions of a more or less pearly lustre, at Castleton, Derbyshire, Auxelle in France, and other places.

Pisolite (Pea-stone). $H.=1.5$; C. white, yellowish, reddish-brown. It occurs in globular concretions sometimes as large as a hazel nut, which are themselves composed of concentric lamellar concretions, and is formed from the mineral waters of Carlsbad in Bohemia, &c.

Chalk. $H.=1.5-2.0$, otherwise friable; C. white, grey, &c.; dull, opaque; adheres to the tongue. It occurs massive, forming the larger portion of the strata in the south-east of England, and spreading through part of France, Denmark, Poland, &c.

Agaric Mineral (Rock Milk). Friable, almost supernatant; C. white, yellowish. It occurs in crusts and loosely cohering particles, which soil the fingers, in Switzerland, Oxfordshire, Durham, &c.

Aphrite (Schaumerde, *W.*). $H.=1.0-1.5$, otherwise quite friable; C. white, yellowish. It occurs in thin laminar concretions and scaly crusts of a pearly lustre, which soil the fingers. Eisleben, in Thuringia, is its principal locality.

Calcareous Tufa (Kalk-Tuff, *W.*). $H.=2.0-3.0$, otherwise friable; C. grey, white, brownish; dull, opaque; porous. It occurs in cellular and spongiform shapes, and encrusting vegetable and osseous substances. It is formed from calcareous springs, in Italy and Germany.

Hydrous or Blue Vesuvian Limestone. $H.=3.0$; C. blue or greenish. It occurs in small rounded masses amongst the ejected minerals from Mount Vesuvius, and contains, according to Klaproth, 11 per cent. of slightly ammoniacal water.

Another variety has been described as occurring of a greenish-white colour in the trap rocks, composing the Giant's Causeway, in Ireland, and containing, according to De Costa, 12 per cent. of water.

Note.—The following impure varieties of carbonate of lime being retained in some mineralogical works, are added as an appendix to the above. They all dissolve with effervescence in acids, but leave behind a considerable residuum.

Marl occurs in a compact or earthy state, generally of a bluish-grey colour, or yellowish, forming beds. It is a mixture of carbonate of lime and clay, and is said to be fusible before the blow-pipe.

Bituminous Marl-Slate occurs in beds, possessing a slaty structure and fracture. Its colour is dark-grey or black, and it occurs in Saxony, the Hartz, Thuringia, &c., mixed with ores of copper, iron pyrites, &c., and abounding in the latter place with carbonized ichthyological remains.

Anthraconite, Madreporite, Swinestone or Stinkstone, occurs massive, in granular and thin columnar concretions, and forming roundish masses. It is usually compact ($H.=3.0$), and of a brown, greyish, or black colour; when rubbed or heated it emits a fetid odour, from which its name is derived. It is found in Salzburg; Dalmatia; Northumberland; Derbyshire, &c.

The black secondary limestone, named Lucullite, may be referred to this variety, as well as the Madreporite, which occurs in roundish masses composed of diverging fibrous concretions.

Calp, or Argillo-feruginous Limestone, occurs massive, and in spheroidal masses, of a bluish or grey colour, and compact. When burnt, it becomes of a buff colour. It is found at Aberthaw, in Glamorganshire (Aberthaw limestone); in Somersetshire, Dorsetshire, &c., forming the "lias limestone;" and in the London clay, in spheroidal masses (often with veins of calc-spar), termed Septaria and Ludus Helmontii; near Harwich, in the Isle of Sheppy, and the neighbourhood of London.

GAYLUSSITE. HYDROUS CARBONATE OF SODA AND LIME.

Gaylussite, *Phil., Cordier, Boussingault.*

Effervesces briskly; $H.=2.0-3.0$; Sp. gr. 1.92—1.95; C. and Sk. white; T. 2, 3, 4; L. vitreous; brittle. It occurs in crystalline groups and lengthened prisms, of which the primary form is an oblique rhombic prism of $109^{\circ} 30'$ and $70^{\circ} 30'$ (*Beudant*).

Before the blow-pipe it fuses instantly into a white enamel, which is slightly alkaline to the taste. When in powder, water dissolves a small portion of it.

C. P. Carbonic acid 28.66, soda 20.44, lime 17.70, water 32.20, alumina 1.0, *Boussingault.*

P. L. Lagunilla, near Merida, in South America, with Trona at the bottom of a lake, in clay.

NATRON. CARBONATE OF SODA.

Effervesces briskly; soluble in water; taste alkaline.

See Sec. 1 of this Division.

TRONA.

Soluble in water; taste alkaline.

See Sec. 1 of this Division.

SECTION 3.

Remarks.—As in the former section, the minerals of the present one are divided, for convenience, into two groups: Group 1, comprising those substances which give out, in burning, a bituminous odour; and Group 2, comprising the remaining minerals, or those which, in burning, are inodorous, or which yield a sulphureous, aromatic, or other odour, not bituminous.

Group 1.

BITUMINOUS COAL.

Coal, *Phil.*; Bituminous Mineral Coal, *M., J.*

This is generally divided into two varieties—black, or common coal; and brown, or wood coal—each of which has been again divided into several sub-varieties.

BLACK COAL. Common Coal.

Generally soils; $H.=1.0-2.5$; Sp. gr. $1.2-1.5$; C. black, often iridescently tarnished; Sk. unchanged, shining; L. resinous, pseudo-metallic; opaque. It occurs massive, forming beds.

It burns with a bright flame and much smoke, giving out a bituminous odour.

C. P. Carbon 75.28, hydrogen 4.18, nitrogen 15.96, oxygen 4.58; from Newcastle, *Thomson*.

P. L. Great Britain, France, Germany, &c. &c., in secondary, and, more rarely, in transition rocks.

Note.—As black coal passes, by close transitions, into brown coal, it is difficult to decide to which variety some of the sub-varieties belong. Jet may be said to unite them, and to belong to both varieties: to black coal, by the strongly bituminous odour which it emits when burning; and to brown coal, by its not soiling, and its woody structure, seen when cut in very thin pieces. The sub-varieties of black coal, as generally enumerated, are—slaty coal, foliated coal, cannel coal (closely allied to jet), and coarse coal; all of which pass into each other.

BROWN COAL. Wood Coal. Lignite.

Does not generally soil; $H.=1.0-2.5$; Sp. gr. $1.2-1.5$; C. brown, blackish-brown; Sk. unchanged, shining; L. resinous; structure more or less fibrous and woody. It occurs massive, generally in ligniform shapes.

It burns with a weak flame, and an odour resembling that of peat. It occurs in tertiary strata, near Bovey Tracey in Devonshire (Bovey coal), in Sussex, and other parts of England; also in France, Prussia, Thuringia, &c.

Note.—The sub-varieties of brown coal, as enumerated, are—Fibrous or ligneous B. C., possessing a visibly fibrous structure; conchoidal B. C., with conchoidal fracture; trapezoidal B. C., or moor coal, which splits into angular and trapezoidal fragments; earthy B. C., in loosely-cohering particles; and aluminous B. C., containing earthy matter and iron-pyrites, which causes it to effloresce when exposed to the atmosphere.

MINERAL PITCH, or BITUMEN.

Bitumen, *Phil.*; Black Mineral Resin, *M., J.*

$H.=2.0$ and under; Sp. gr. $1.0-1.2$; C. black, brown, greenish, reddish-brown; L. resinous; sectile, elastic, or brittle. Occurs massive, reniform, sometimes in an earthy state.

Before the blow-pipe it burns with a bright flame, giving out a strongly bituminous odour. By heat it is rendered viscid.

C. P. of the elastic varieties of England: Carbon 52.250, hydrogen 7.496, oxygen 40.100, nitrogen 0.154, *Henry*.

It is generally divided into three varieties: earthy mineral pitch, from Hurlet near Paisley, Persia, &c.; elastic mineral pitch, or elaterite, from Derbyshire, and Montrelais in France; and slaggy or compact mineral pitch, which becomes brittle on exposure, and has a conchoidal fracture, from Switzerland, Albania, Barbadoes, Judea, &c.

HATCHETINE.

Id. Phil., Beud.; Mountain Tallow.

H.=1.0 or less; C. white or yellowish; L. pearly, resinous. It occurs in translucent flakes, or massive and opaque.

It melts in warm water, and gives out, by distillation, a bituminous odour.

Its locality is Merthyr Tydvil in South Wales, where it occurs with calc-spar and quartz in argillaceous ironstone.

OZOKERITE.

Id. Phil.

H.=1.0 or less; Sp. gr. 0.955; translucent; C. yellowish-brown.

It occurs massive, and softens by the heat of the hand.

Readily fusible, burning with a bright flame, and emitting a bituminous odour.

It is found at Slanik in Moldavia.

Group II.

SULPHUR.

Id. Phil.; Prismatic Sulphur, *M., J.*

H.=1.5—2.5; Sp. gr. 1.9—2.1; C. yellow, brown, grey, greenish;

Sk. pale yellowish; L. resinous; T. 3, 4. It occurs massive, stalaclitic, in granular concretions, pulverulent, and crystallized, in acute octahedrons, variously modified (fig. 195 to 198).

Primary form, a double four-sided pyramid, with rhombic base.

Fusible in the flame of a candle, burning with a blue flame, and emitting a sulphureous odour; no residuum.

P. L. Sicily, Italy, Spain, Poland, and Iceland, in volcanic rocks; and in secondary and tertiary strata, with gypsum, rock-salt, &c.

SULPHURETS OF ARSENIC.

Realgar.—C. red; Sk. orange-yellow.

Orpiment.—C. yellow; Sk. pale-yellow.

Burning, fusing, and volatilizing before the blow-pipe, with a strong alliaceous odour. See Sec. 5 of this Division.

AMBER.

Amber, *Phil.*; Yellow Mineral Resin, *M., J.*; Bernstein, *W.*; Succin, *H., Beud.*

H.=2.0—2.5; Sp. gr. 0.8—1.2; C. yellow, brown, yellowish-white;

L. resinous; T. 2, 4. Occurs massive, in rolled pieces, and is easily rendered electric, resinously, by friction.

Burns in the flame of a candle, with a yellow flame and aromatic odour, leaving behind a very small coaly residuum.

C. P. Carbon 80.59 (70.68), hydrogen 7.31 (11.62), oxygen 6.73 (7.77), *Drapier. (Ure.)*

P. L. The Prussian and Sicilian coasts, and those of Norfolk and Suffolk. In brown coal, Hasen Island, Greenland; also in Poland, France, &c.

RETINASPHALT.

Id. Hatchett, Phil.; Retinite, *J.*

H.=1.0—2.0; Sp. gr. 1.1—1.2; C. brownish-yellow; L. resinous; opaque. Occurs in amorphous masses, sometimes earthy.

Burns with a bright flame and fragrant odour, which sometimes becomes slightly bituminous.

C. P. Resin, soluble in alcohol 55, insoluble bituminous matter 41, earthy substances 5, *Hatchett*.

P. L. Bovey Tracey in Devonshire, with brown coal. Wolchow in Moravia.

Note.—Several substances analogous to the above occur in tertiary deposits, with lignite, at St Paulet, in the department of Gard, in France; also near Halle in Switzerland, Nauenberg in Thuringia, and other places; often of two or three colours (yellow, grey, &c.), disposed in concentric stripes.

FOSSIL COPAL, OR HIGHGATE RESIN.

Id. Aikin, Phil.

H. about 2.5; Sp. gr. 1.046; C. light-yellow, brown; L. resinous; T. 2. Occurs in irregular nodules; brittle.

Burns in the flame of a candle with an aromatic odour.

It is found in blue clay (London clay) at Highgate, near London.

SCHERERITE.

Id. Stromeyer, Phil., Beud.

Friable; C. white; L. pearly. Occurs in crystalline grains and scales.

Melts at a low temperature into a colourless liquid, exhaling an aromatic odour; on cooling it crystallizes in needle-like prisms.

Exposed to flame, it burns entirely away. It is soluble in alcohol.

It occurs with lignite in the Westerwald of Switzerland, near St Gall, &c., and is a compound of carbon and hydrogen.

ANTHRACITE.

Id. Phil., Beud.; Non-bituminous Mineral Coal, *M., J.*; Glance Coal.

H. = 2.0—2.5, or friable; Sp. gr. 1.4—1.8; C. iron-black, sometimes tarnished; L. imperfect metallic; opaque.

Burns with difficulty, and without flame, smoke, or odour, leaving a white ash.

C. P. Carbon, with traces of hydrogen, and mixed with 4 or 5 per cent. of earthy matter. *Beudant*.

It has been divided into several varieties, namely:

Conchoidal or Massive Anthracite, possessing a conchoidal fracture and a somewhat compact structure, from the Meissner in Hessa, &c.; Slaty Anthracite, of an imperfectly slaty structure, from the coal formations of Staffordshire, Wales, Kilkenny in Ireland, Scotland, North America, &c.; Columnar Anthracite, in short, and straight or curved prismatic concretions, from Meissner in Hessa, Ayrshire, and Newcastle; and lastly, Fibrous Anthracite, or Mineral Charcoal, in delicate fibrous concretions of a silky black colour, which soil strongly, and are disposed in thin layers in common coal, in most of the coal fields of Great Britain, &c.

DYSODILE.

Id. Phil.; Dusodyle, *Cordier, Beud.*; Terre bitumineuse feuilletée; Merda di Diavolo. Paper Coal.

Occurs in foliated masses of a brown, greenish-grey or yellow colour, which are soft, and somewhat flexible and elastic.

It burns easily with flame and smoke, giving out a powerfully fetid odour.

It occurs at Mellili, near Syracuse, in Sicily, in thin beds, in secondary limestone. Also at Salzhausen in Hessa.

MELLITE. MELLATE OF ALUMINA.

Mellite, *Phil.*; Pyramidal Mellichrone Resin, *M.*; Honeystone.

H. = 2.0—2.5; Sp. gr. 1.5—1.66; C. yellow, brown, reddish; Sk. greyish-white; L. resinous, vitreo-resinous; T. 2, 3; brittle. It occurs massive, and in truncated octahedrons. P. F. the octahedron, with square base.

Before the blow-pipe it becomes white and opaque, and is at length reduced to ashes, but without smoke or flame. If this residue be moistened with a drop of nitrate of cobalt, and again heated, it will become blue.

C. P. Mellitic acid 46·0, alumina 16·0, water 38·0, *Klapr.*

P. L. Artern in Thuringia, with lignite, &c.

SUPER-SULPHURET OF LEAD.

Earthy (?), of a bluish-grey colour, and so highly inflammable as to take fire and burn on being held in the flame of a candle. It occurs in the Dufton Lead Mines. The above is taken from Phillips's 'Mineralogy.' I have never met with any specimens of this substance which did not possess a metallic lustre, agreeing in aspect with the compact varieties of galena. The super-sulphuret is generally surrounded by, or mixed with, earthy sulphate of lead, which is not inflammable, although easily reducible before the blow-pipe. See Part II.

PYRORTHITE.

Id. Berz., Phil., Beud.

H.=2·5; Sp. gr. 2·19; C. brownish-black; when decomposed, yellowish; Sk. unchanged, resinous; L. O. resinous. It occurs in fibrous and baccillary concretions.

Before the blow-pipe it burns without smoke, and afterwards becomes white or grey, and melts with difficulty into a dull black globule. With borax it gives the reactions of cerium. With soda it forms a tumefied mass, and on the platina wire or foil, gives traces of manganese.

C. P. Protoxide of cerium 13·92, silica 10·43, lime 1·81, alumina 3·59, protoxide of iron 6·08, protoxide of manganese 1·39, yttria 4·87, water 26·50, carbon 31·41, *Berz.*

P. L. Kararfvet, near Fahlun, in Sweden, in granite with gadolinite.

HUMBOLDTITE. OXALATE OF IRON.

Id. Beud.; Oxalate of Iron, Phil.

H.=1·0—2·0; Sp. gr. about 1·3—1·5; (2·13 Leonhard); C. yellow; dull; opaque. It occurs in small crystalline masses.

Before the blow-pipe, on charcoal, it gives out a vegetable odour, leaving behind a black or red residuum, attractable by the magnet.

C. P. Oxalic acid 46·14, protoxide of iron 53·86, *M. de Rivero.*

P. L. Koloseruk, near Bilin, in Bohemia, with moor-coal.

SECTION 4.

Remarks.—All the minerals of this section yield to the nail, and many occur in a friable state, being decomposed or impure varieties of several species, which are described in other sections of this work; or otherwise merely mechanical mixtures, which are only retained here, on account of their being still generally described in mineralogical systems.

BLACK CHALK, OR DRAWING SLATE.

Id. Phil., Zeichen-schiefer, W.

Soils and writes; H. about 1·5; Sp. gr. 2·1—2·2; C. greyish and bluish-black; Sk. shining, unchanged; L. 0 or 1. Occurs massive; Fr. slaty or earthy; sectile; meagre to the touch; opaque.

P. L. Italy, Spain, France, Bayreuth in Thuringia, in clay-slate, &c. It contains silica, alumina, carbon, oxide of iron, and water.

SCALY VAR. OF RED IRON ORE.

Red Iron Froth.

Soils; C. red; Sk. red; in slightly cohering scaly particles; infusible.

See Red Iron Ore, per Index.

OCHREOUS VAR. OF RED IRON ORE.

Reddle.

Soils strongly and writes; C. red; Sk. red, somewhat shining.

Occurs massive; Fr. earthy; infusible.

See Red Iron Ore, per Index.

OCHREOUS VAR. OF BROWN IRON ORE.

Brown Iron Ochre.

Soils more or less strongly; friable; C. brown, yellow; Sk. yellowish. It occurs massive; Fr. earthy; infusible.

See Brown Iron Ore.

UMBER.

Id. J., Phil.

Writes, but scarcely soils; H.=1·0—1·5, if not friable; C. dark liver, or yellowish-brown; Sk. shining. Occurs massive; dull; opaque; adheres to the tongue.

Infusible, burns red.

It occurs with brown jasper, in the Island of Cyprus, and appears to be a decomposed hydrous oxide of iron, containing oxide of manganese, and mixed in variable proportions with siliceous and earthy matter.

EARTHY OR FRIABLE VAR. OF MANGANITE.

Wad, Phil., Earthy Manganese.

Stains the fingers; H.=1·0 or 1·5, if not friable; C. blackish or reddish-brown, grey. It occurs massive, and in loose glimmering particles on other minerals.

Infusible; imparts to soda, in an intense degree, the green colour indicative of manganese.

See Manganite.

CAPILLARY VAR. OF KERMESITE, OR RED ANTIMONY.

Tinder Ore, *Zundererz.*

Soils more or less strongly; C. red, brownish, or bluish-grey; Sk. brownish-red. It occurs in delicate fibrous concretions or interlaced acicular crystals.

Very easily fusible, and, in great part, volatilizable, leaving behind a small bead of silver.

See Kermesite.

VAR. OF CALCITE.	{	APHRITE. AGARIC MINERAL CHALK.	}	Soil and write; effervesce in acids. See Sec. 2 of this Division.
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PHARMACOLITE. ARSENIATE OF LIME.

Soils (in some varieties).

Yields before the blow-pipe a strong alliaceous odour.

See Sec. 5 of this Division.

BITUMINOUS COAL.

Soil generally strongly ;

MINERAL CHARCOAL,

combustible.

VAR. OF ANTHRACITE. } See Sec. 3 of this Division.

YELLOW EARTH.

Id. Jameson.

Soils and writes slightly ; H. about 1·0—1·5 or friable ; Sp. gr.

2·24 (Breithaupt) ; C. ochre-yellow, shining in the Sk. ; opaque.

Falls to pieces in water ; adheres to the tongue.

Infusible, becomes red by calcination.

It occurs in Lusatia (at Wehrau), in France, &c. It is a mixture of oxide of iron, sand, and earthy matter, and cannot strictly be considered as a distinct substance from umber.

BOLE.

Id. Phil. J.

H. about 1·5 ; Sp. gr. 1·6—2·0 ; C. red, yellow, brownish, shining in the Sk. ; T. 0, 1, 2 ; L. 0 or 1 ; adheres to the tongue ; feels rather greasy. Occurs massive ; Fr. conchoidal.

Falls to pieces in water, with a crackling noise.

Fusible into a dark slag.

P. L. Striegau in Silesia, Saxony, Hesse, &c.

FULLER'S EARTH.

Id. Phil. J., Walkerde, W.

H. about 1·5 ; Sp. gr. 1·8—2·2 ; C. greenish-grey, shining in the Sk. ; T. 0 or 1 ; very sectile ; feels greasy.

Falls to pieces in water, forming a paste.

Fusible into a pale greenish or colourless blebby glass.

C. P. Silica 53·0, alumina 10·0, peroxide of iron 9·75, water 24·0, magnesia 1·25, lime 0·50, chloride of sodium 0·10, with traces of potassa, *Klapr.*

P. L. Nutfield, near Reigate, in Surrey ; near Woburn, in Bedfordshire ; at Old Town, near Bath, and other parts of England, in regular beds. Also at Rosswein, in Saxony.

CIMOLITE.

Id. Phil.

H.=1·5 and less ; Sp. gr. about 2·0 ; C. grey or reddish ; dull ; opaque ; Fr. earthy ; adheres to the tongue.

Falls to pieces in water. Infusible.

C. P. Silica 63, alumina 23, water 12, oxide of iron 1·25, *Klapr.*

P. L. The Island of Argenteria (formerly called Cimola), near the Island of Milo.

LEMNIAN EARTH, OR SPHRAGIDE.

H.=1·0—1·5 ; C. yellowish-white or grey ; dull ; opaque ; Fr. earthy.

Falls to pieces in water. Infusible.

C. P. Silica 66, alumina 14·50, water 8·50, oxide of iron 6, soda 3·50, lime and magnesia,—traces, *Klapr.*

P. L. The Island of Lemnos.

TRIPOLI.

Id. Phil., Jam.

Occurs of a white or yellowish colour, at Tripoli in Africa, in the Puy de Dome, France, and other places, and is only an arenaceous variety of quartz mixed with clay, and sometimes coloured by oxide of iron. It is very harsh to the touch.

CLAY.

Common Clay, &c., *Jam.*; Pipe-clay, &c., *Phil.*

H. = 1·0—1·5 or less; Sp. gr. 1·8—2·7; C. chiefly dark or light grey, also white, dark blue, greenish, &c.; dull; opaque; adheres more or less to the tongue. Occurs massive, in large beds. Falls to pieces or becomes plastic in water.

The following varieties are enumerated :—

Common Clay: Pipe clay, of a greyish or yellowish-white colour, and very plastic; Potter's clay, of a bluish or greenish colour, scarcely differing from the above; Slaty clay, of a somewhat slaty texture; Variegated clay, &c.

Clay is an hydrous silicate of alumina, generally coloured by oxide of iron, and arises from a mixture of decomposed minerals.

Note.—The “adhesive slate” in which the menilite is embedded in the gypsum formation of Paris, may likewise be referred to the above. It is very soft, of a yellowish or grey colour, and slaty texture. It absorbs water eagerly (but does not fall to pieces in it), and adheres strongly to the tongue.

The decomposed variety of Felspar (*Kaolin*, *Porcelain clay*) may also be mentioned in this place. It is earthy and friable, generally of a white or greyish colour, and stains the fingers, sometimes only slightly. It occurs in Cornwall, at St Yriex in France, &c., and usually contains crystals or fragments of undecomposed felspar, quartz, and mica. See Felspar.

LENZINITE.

Id. Phil., Beud.

Of this substance two varieties occur; the second perhaps arising from the decomposition of the first.

OPALINE LENZINITE.

H. about 2·5; Sp. gr. about 2·1; C. milk-white; Sk. unchanged; T. 2, 1; Fr. flat conchoidal; rather greasy to the touch; adheres to the tongue. It occurs massive. In water it separates into small transparent pieces. Infusible.

ARGILLACEOUS LENZINITE.

Friable or slightly cohering; C. white or yellowish; dull; Fr. earthy; adheres strongly to the tongue.

Breaks down in water with much sediment. Infusible; becomes hard on exposure to heat.

C. P. alumina 37·5, silica 37·5, water 25·0, *John.*

L. of both varieties; Kall in Eilfield.

KOLLYRITE.

Id. Phil.; Collyrite, Beud.

H. about 1·5; Sp. gr. 2·06—2·11. It occurs in white masses, bearing some resemblance to gum. Absorbs water eagerly, but does not fall to pieces in it. See Sec. 7, A, of this Division.

HALLOYSITE.

Id. Phil., Beud.

H. about 1·5; Sp. gr. 1·8—2·1; C. bluish-white; L. waxy; absorbs water, but does not fall to pieces in it. See Sec. 7, A, of this Division.

LITHOMARGE.

Id. Phil., &c.

H. about 1.5, if not friable; Sp. gr. 2.43; feels greasy; adheres strongly to the tongue. Imbibes water, but does not fall to pieces in it. See Sec. 7, A, of this Division.

KEFFEKIL, SILICATE OF MAGNESIA.

Magnesite, Beud.; Meerschaum.

H. about 1.5; C. white or yellowish; L. waxy; very difficultly fusible. Imbibes water, but does not fall to pieces in it. See Sec. 6, A, of this Division.

Note.—The following substances often stain or soil slightly, and are therefore placed as an Appendix to the above. For their respective descriptions consult the Index.

Earthy var. of Argyrose: greyish-black. Fusible, giving globules of silver. Melanconise: black. Fusible, giving globules of copper.

Earthy Feruginous var. of Ruberite (Earthy Tile Ore): Powder, reddish-brown. Infusible; with borax giving the reactions of copper and iron.

Earthy var. of Vivianite: greenish or greyish-white, on exposure becoming blue. Fusible into a globule attractable by the magnet.

Earthy var. of Lead-spar: greyish, sometimes green, red, &c. Soluble with effervescence in acids. Reducible, covering the charcoal with a yellow crust of oxide of lead.

Earthy var. of Zinc-spar: greyish, yellowish, &c. Effervescent in acids. Infusible.

Oxide of Bismuth: yellow, fusible, and reducible on charcoal. Soluble in nitric acid, precipitated white by water.

Stibiconise: yellowish. Infusible and not reducible. Volatilizable on charcoal in the R. F.

Exitelite: white, sometimes pearly. Fusible and volatilizable. Reducible on charcoal.

Oxide of Cobalt: blackish. Infusible. With borax yielding a deep blue glass.

Earthy var. of Erythrine: red, brownish. Fusible, emitting arsenical fumes. With borax giving (after roasting) a blue glass.

Arsenate of Nickel: greenish, blackish. Fusible, with arsenical fumes, into a brittle metallic globule. Partly soluble in nitric acid; solution green, turning violet on the addition of ammonia.

Oxide of Uranium: yellow, reddish. Infusible; with borax forming in the O. F. a yellow, and in the R. F. a dirty-green glass. Acted on by nitric acid; solution, yellow.

Earthy var. of Gypsum: white, grey. Fusible into a white enamel. Giving the reactions of sulphur with soda and silica.

Earthy var. of Barytine: white, reddish, &c. Heavy. Fusible into a white enamel, possessing a nauseous taste.

Hydrate of Magnesia: white, pearly. Infusible; when calcined, acts as an alkali on turmeric paper.

Websterite: white, very light. Curling up before the blow-pipe, and forming an infusible ramified mass.

Earthy var. of Fluor Spar: white, greyish-blue, reddish, &c. Fusible with slight phosphorescence into a white enamel.

SECTION 5.

Remarks.—The minerals of this Section are likewise arranged in two groups: the first consisting of those which, when exposed to the action of the blow-pipe, leave behind a residue, or are reduced; and the second containing those which are entirely volatilizable before the blow-pipe. In both instances the heaviest substances are placed first.

Group I.

MIMETESE. ARSENIATE OF LEAD.

Mimetesc, *Beud.*; Arseniate of Lead, *Phil.*

H.=3·5—4·0; Sp. gr. 6·9—7·3; C. yellow, green, white (red, when containing a minute portion of chromate of lead); Sk. white; L. vitreo-resinous. Occurs mammillated, reniform, filamentous, and crystallized (fig. 98 and 123). P. F. regular hexahedral prism.

On charcoal, fusible, and partly volatilizable, leaving on the support globules of lead. With salt of phosphorus and oxide of copper it gives a green colour to the flame.

C. P. Arsenic acid 21·20, phosph. acid 1·32, oxide of lead 67·89, chloride of lead 9·60, *Wohler*.

P. L. Johanngeorgenstadt in Saxony; Cornwall; Leadhills, &c. Huelgoet, and in Auvergne, France.

Note.—This substance is often mixed with a considerable portion of phosphate of lead, in which case, after fusion, it crystallizes more or less regularly upon cooling; the alliaceous odour which it emits is, however, alone sufficient to distinguish it from the phosphate. From this circumstance, as well as from its close resemblance to the Pyromorphite, the name of Mimetese (*μιμήτης*, imitator) was bestowed upon it by Beudant.

PROUSTITE. SULPHURET OF ARSENIC AND SILVER.

Id. Beud.; Light-red Silver, *Phil.*; Rhombohedral Ruby-Blende (in part), *M.*

H.=2·0—2·5; Sp. gr. 5·4—5·6; C. red; Sk. light red; T. 2, 3. It occurs massive and crystallized (fig. 93, 110, 110 a). P. F. a rhombohedron of 108° 30' and 71° 30', or nearly so.

Before the blow-pipe it decrepitates, gives out arsenical fumes, fuses, and is reduced.

C. P. Sulphur 19·51, arsenic 15·09, antimony 0·69, silver 64·67, *Rose*.

P. L. Joachimsthal in Bohemia; Johanngeorgenstadt, Marienberg, Freyberg in Saxony; Hungary, Mexico, &c., in primitive rocks, with native arsenic, galena, iron-pyrites, and other minerals.

See the note to Argrythrose, Sec. 6, B.

ARSENIATE OF COPPER.

H.=1·0—5·0; Sp. gr. 2·5—4·6; C. green, blue, grey, brownish, blackish, paler in the streak. Reducible on charcoal, *per se*, into a white metallic globule (arseniuret of copper). Acted on by nitric acid. The copper precipitated readily from the solution on a bar of iron.

SUBSP. 1. OLIVENITE.

Id. Beud.; Right Prismatic Arseniate, *Phil.*; Prismatic Olive Malachite, *M.*; Olivenerz, *W.*

H.=3·0—4·0; Sp. gr. 4·2—4·6; C. olive-green, grey, brown, rather

paler in the Sk. Occurs in fibrous and lamellar concretions, mammillated (Wood-copper), massive, in crusts, and minute prismatic crystals. P. F. a right rhombic prism of $110^{\circ} 50'$ and $69^{\circ} 10'$.

On charcoal, fuses with a sudden kind of detonation, and is reduced into a white metallic globule, which on cooling becomes covered over with a reddish coating. If this metallic globule be poured off before it have time to cool, a scoria will remain behind on the charcoal, which, when mixed with about an equal quantity of metallic lead, and again fused, will yield a white (not metallic) globule of phosphate of lead, crystallizing on cooling.

C. P. Oxide of copper 56.63, arsenic acid 36.71, phosphoric acid 3.36, water 3.50, *Kobell*.

P. L. Huel Gorland, Huel Unity, &c., in Cornwall.

SUBSP. 2. APHANESE.

Id. Beud. ($\alpha\phi\alpha\nu\varsigma$, not apparent); Oblique Prismatic Arseniate, *Phil.*; Axotomous Habroneme Malachite, *Haid*.

H. = 2.5—3.0 (3.25?) Sp. gr. 4.1—4.28; C. bluish-black, greenish-blue; Sk. pale-green. Occurs massive, in lamellar concretions, and in minute oblique rhombic prisms sometimes fasciculated. P. F. an oblique rhombic prism of 124° and 26° .

Fusible, on charcoal, into a globule, which crystallizes at the surface on cooling. Reducible in a good heat. Gives, when treated with lead (see the preceding subspecies), indications of phosphoric acid.

C. P. Oxide of copper, arsenic acid, phosphoric acid, and a considerable quantity of water, which it gives off when heated in a small matrass over the spirit lamp. The Olivenite, treated in a similar manner, gives off no perceptible quantity.

P. L. Huel Gorland, &c., Cornwall.

SUBSP. 3. ERINITE.

Id. Phil.; Dystomic Habroneme Malachite, *M.*; *Haid*.

H. = 4.0—5.0; Sp. gr. 4.0—4.1; C. emerald-green, paler in the Sk. Occurs in mammillated semi-crystalline masses, of a fibrous and concentric-lamellar structure. P. F. unknown.

Fusible and reducible in part, on charcoal.

C. P. Oxide of copper 59.44, arsenic acid 33.78, alumina 1.77, water 5.01, *Turner*.

P. L. County of Limerick, Ireland.

Note.—Beudant, in his 'Mineralogie,' 2nd edition, has united this subspecies with the Euchlorose, or Micaceous Arseniate, from which its much higher Sp. gr. will easily distinguish it.

SUBSP. 4. EUCHROITE.

Id. Phil.; *Id. Breithaupt*; Prismatic Emerald Malachite, *M.*

H. = 3.5—4.0; Sp. gr. 3.38—3.41; C. bright emerald-green, paler in the Sk. Occurs in right rhombic prisms variously modified. P. F. a right rhombic prism of $117^{\circ} 20'$. Gives off water in the matrass, and becomes yellowish and friable. Fusible on charcoal, with detonation (like the Olivenite), and in part reducible. When treated with lead (see Olivenite), it gives indications of phosphoric acid.

C. P. Oxide of copper 47.85, arsenic acid 33.02, water 18.80, *Turner*.

P. L. Libethen in Hungary. It is a rare mineral.

SUBSP. 5. LEIROCHROITE. (*λεῖρος*, pale, *χρoία*, colour.)Kupferschaum *W.*, *Phil.*; Prismatic Euchlore Mica, *M.*

H.=1·0—1·5; Sp. gr. 3·0—3·2; C. pale-green inclining to sky-blue, still paler in the Sk. Occurs in diverging fibrous concretions and scaly particles, also in thin tabular rhombic crystals. P. F. a right rhombic prism. The thin laminæ are flexible. Fusible into a dark scoria, mixed with reduced grains of copper. Gives off water in the matrass.

P. L. The Bannat; Libethen, in Hungary; the Tyrol; Matlock, in Derbyshire, &c.

Note.—The following analysis has been given of this substance by Kobell, but it probably contains besides a portion of phosphoric acid. Oxide of copper 43·88, arsenic acid 25·01, water 17·46, carbonate of lime (probably matrix), 13·65, *Kobell*.

SUBSP. 6. LIROCONITE.

Id. Beud.; Octahedral Arseniate, *Phil.*; Prismatic Lirocone Malachite, *M.* (*λεῖρος*, pale, *χρoία*, powder).

H.=2·0—2·5; Sp. gr. 2·85—2·95; C. light-blue, green, paler in the Sk., almost white. It occurs in small flat or obtuse octahedrons, often rounded, and with convex surfaces. These crystals are sometimes grouped into mammillated and other shapes. P. F. an obtuse rectangular octahedron.

Fusible and reducible on charcoal into white metallic grains, generally surrounded by a dark scoria. Giving off a large quantity of water in the matrass.

C. P. Oxide of copper 49, arsenic acid 14, water 35, *Chenevix*.

Wachmeister found it to contain, besides the above, alumina, silica, oxide of iron, and phosphoric acid.

P. L. The mines of Cornwall.

SUBSP. 7. EUCHLOROSE (from *ευχλωρος*, bright green).

Rhombohedral Arseniate, *Phil.*; Rhombohedral Euchlore Mica, *M.*; Cypromica, *Necker*; Copper Mica.

H.=2·0; Sp. gr. 2·5—2·6; C. emerald-green, grass-green, paler in the Sk. Occurs in granular and thin lamellar concretions, also in small six-sided tabular crystals often grouped together into rosettes. P. F. an acute rhomboid of about 110° 30' and 69° 30'.

Before the blow-pipe it decrepitates (flying off into minute scales), and in a good heat on charcoal is fused into a scoria, containing white grains of the reduced metal. Gives off water in the matrass.

C. P. Oxide of copper 39, arsenic acid 43, water 17, *Vaug.*

P. L. The mines of Cornwall, and Gunnis Lake mine, on the Tamar, Devonshire.

SCORODITE. ARSENIATE OF COPPER AND IRON.

Id. Beud., *Phil.*; Martial Arseniate of Copper.

H.=3·5—4·0; Sp. gr. 3·1—3·2; C. green, brown, greenish-blue, greyish; Sk. white, or nearly so. It occurs in very small crystals derived from a right rhombic prism of 120° 10', and 59° 50'.

Fusible on charcoal with copious arsenical fumes into a reddish-brown or blackish metallic-looking scoria, which acts on the magnet. Gives off water in the matrass, and turns first yellowish and subsequently black.

C P. Arsenic acid 33·51, oxide of copper 22·50, oxide of iron 27·50, water 12, *Chenevix*.

Arsenic acid 15·7, sulphuric acid 0·7, protoxide of iron with the oxides of manganese, lime, and magnesia 23·9, water 9 0, *Ficinus*.

A few careful analyses of this substance are much required.

P. L. The mines of Cornwall; Löling, in Carinthia; Saxony, &c., Brazil.

ERYTHRINE. ARSENIATE OF COBALT.

Erythrine, *Beud*; Cobalt Bloom, *Phil*; Prismatic Cobalt Mica, *M*.

H.=2·0—2·5, otherwise it is friable; Sp. gr. 2·9—3·1; C. red chiefly, sometimes greyish, rarely green; paler in the Sk. Occurs in stellular and scopiform fibrous concretions, massive, botryoidal, in earthy crusts, and in small oblique rectangular prisms.

Fusible into a brittle metallic globule (arseniuret of cobalt), which imparts to borax a deep blue colour, particularly in the O. F. Gives off water in the matrass. Partly soluble in nitric acid; colour of solution, rose-red.

C. P. Arsenic acid 37, oxide of cobalt 39, water 22, *Bucholz*.

P. L. Schneeberg, in Saxony; Platten, in Bohemia (green); Dauphiné; Cornwall; Cumberland.

Another species has likewise been described by M. Levy, under the name of Roselite, which occurs with Erythrine at Schneeberg, in small (twin) rhomboidal prisms of 132° and 48°. Colour red; Sk. white; H.=3·0; L. vitreous; translucent; blackening and giving off water before the blow-pipe, and resembling in other respects the Erythrine.

PHARMACOSIDERITE. ARSENIATE OF IRON.

Pharmacosiderite, *Beud.*, *Haus.*; Arseniate of Iron, *Phil*; Hexahedral Liricone Malachite, *M*; Cube Ore.

H.=2·5; Sp. gr. 2·9—3·0; C. green, yellowish-brown; Sk. pale-green. Occurs very rarely massive, chiefly crystallized in small cubes, simple and truncated on the alternate angles. P. F. the cube.

Fusible into a grey metallic scoria, attractable by the magnet. In the matrass gives off water and becomes red.

C. P. Arsenic acid 37·82, phosphoric acid 2·63, peroxide of iron 39·20, oxide of copper 0·65, water 18·61, insoluble matter 1·76, *Berz*.

P. L. The mines of Cornwall; more rarely near Limoges, in France, and Schneeberg, Saxony.

Note.—A variety of arseniate of iron from Villa Rica, Brazil, has been described as a separate species by Beudant, under the name of Neotese (*νεος*, new, and *κτησις*, acquisition). It is of a green colour, crystallizing in oblique rectangular prisms, and taking a yellow colour after giving off its water in the matrass. It yielded to Berzelius,—arsenic acid 50·78, peroxide of iron 34·85, water 15·55, arseniate of alumina 0·67, phosphoric acid and oxide of copper, traces.

Another variety of arseniate of iron, containing a considerable proportion of silver,* and often, if not always, arseniate of cobalt, is called by the Germans "Gansekothigerz," and appears to be partly the Rhodoise of Beudant. It is of a yellowish or greenish colour, and sometimes red, when mixed with a large proportion of arseniate of cobalt, being then generally in an earthy state; otherwise its hardness is from 2·0 to 3·0. It is said to fuse in a good heat, into a black scoria, strongly attractable by the magnet, and containing a small bead of silver. Beudant describes the Rhodoise as being red, earthy, imparting a blue tinge to glass of borax, and becoming yellow when deprived of its water in the matrass.

* Of course mechanically mixed.

PHARMACOLITE. ARSENIATE OF LIME.

Id. Beud., Phil.; Hemi-prismatic Gypsum Haloide, *Haid.*

H.=2.0—2.5; Sp. gr. 2.64—2.8; C. white, sometimes stained red or bluish on the surface by arseniate of cobalt; Sk. white. It occurs in fibrous or acicular crystals grouped together, more rarely in very small separate crystals. P. F. a rhomboidal prism. Fusible into a white enamel, and almost entirely volatilizable; the residue acts as an alkali on turmeric or Brazil-wood paper. Gives off water in the matrass.

C. P. Arsenic acid 50.54, lime 25.00, water 24.46, *Klappr.*

P. L. Wittichen, in Swabia; Andreasberg in the Hartz; Riegelsdorf in Hessia, &c.

Note.—The Picro-pharmacolite of Stromeyer (Arsenicite of Beudant) contains three or four per cent. of magnesia, but in other respects resembles the above. It occurs at Riegelsdorf, in Hessia. Another species has been described under the name of Haidingerite (from the celebrated mineralogist by whom it was distinguished). H.=2.0—2.5; Sp. gr. 2.84—2.85; C. and Sk. white; T. 4; lustre vitreous (that of the pharmacolite being pearly). P. F. a rectangular four-sided prism. It occurs at Baden, but is very rare. C. P. arseniate of lime 85.681, water 14.319, *Turner.*

SIDERATINE.

ARSENIATE SULPHATE	} OF IRON.
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Sideratine, *Beud.*; partly the Pitchy Iron Ore of *Phil.*; Eisensinter, partly, *W.* H.=2.0—2.5; Sp. gr. about 2.2; C. brown, yellow, paler in the Sk.; translucent; L. resinous. It occurs in reniform masses.

Fusible with arsenical fumes into a blackish globule which attracts the magnet. Gives off water in the matrass and becomes red.

C. P. Arsenic acid 20, sulphuric acid 14, peroxide of iron 35, water 30, *Laugier.*

P. L. Schneeberg in Saxony, &c., in old mines where it appears to be formed from the decomposition of arsenio-sulphurets. It is often confounded with the Pittzitze, which occurs with it.

ARSENIATE OF NICKEL.

Nickel-ocre, *Beud., Phil.*

Friable, or H.=1.0; C. green, greenish-white, the same in the Sk. It occurs in crusts and filamentous coatings on the arseniuret of nickel.

Fusible into a brittle metallic globule. With borax it produces the reactions of nickel unless it contains arseniate of cobalt, in which case it yields a blue glass. Gives off water in the matrass. Partly soluble in nitric acid; solution green, becoming violet on the addition of ammonia.

C. P. arsenic acid 36.8, oxide of nickel 36.2, oxide of cobalt 2.5, water 24.5, *Berthier.*

P. L. Allemont in Dauphiné.

PEROXIDE OF COBALT.

Id. Beud.; Earthy Cobalt, *Phil.*

Friable, or H.=about 1.0; Sp. gr. 2.10—2.42; C. black, bluish-black, brown; dull, but acquires a polish by friction. Occurs in crusts, botryoidal, &c. Infusible *per se*; when pure it gives no alliaceous odour, but being generally mixed with a small proportion of arseniate of cobalt, the odour of arsenic is, in most instances, developed. Imparts a deep blue colour to borax, and often a green colour to soda on the platina wire, in consequence of being mixed with oxide of manganese.

C. P. When pure, oxygen 28·90, cobalt 71·10, *Beud.*

P. L. Alderley Edge, Cheshire (with copper pyrites); Saalfeld in Thuringia; Bohemia; Saxony; Siberia, &c.

Note.—Some of the impure varieties give off a considerable quantity of water in the matrass.

Group II.

ARSENIC ACID.

Id. Beud.; Oxide of Arsenic, *Phil.*

H.=1·5 or less; Sp. gr. 3·6—3·71; C. white, sometimes tinged reddish, &c. Soluble in water; taste, sweetish-astringent. See Section 1 of this Division.

SULPHURET OF ARSENIC.

This combination includes two species, both sulphurets of arsenic, but differing in the proportions of their constituent parts, as well as in primary form, &c.

REALGAR.

Id. Beud., Phil., &c.; Hemi-prismatic Sulphur, *M.*

H.=1·5—2·0; Sp. gr. 3·5—3·6; C. red; Sk. orange-yellow; L. adamantine. It occurs in flakes, massive and crystallized (fig. 205). P. F. an oblique rhombic prism of about 105° 30' and 74° 30'.

Before the blow-pipe it burns with a yellowish flame and arsenical odour, at the same time fusing and volatilizing.

C. P. Sulphur 31, arsenic 69, *Klapr.*

P. L. Felsobanya in Upper Hungary; Kapnik and Nagyag in Transylvania; Andreasberg, Hartz, &c.; in primitive rocks. Also at Vesuvius.

ORPIMENT.

Id. Beud., Phil., &c.; Prismatic Sulphur, *M.*

H.=1·5—2·0; Sp. gr. 3·4—3·6; C. lemon or gold-yellow; Sk. lemon-yellow; L. adamantine, sometimes inclining to semi-metallic. It occurs in lamellar and granular concretions, stalactitic, botryoidal, in crusts, and rarely in minute crystals, derived from a right rhombic prism of 100° and 80°. (?)

Before the blow-pipe it behaves like Realgar, but the flame is sometimes of a bluish colour.

C. P. Sulphur 38, arsenic 62, *Klapr.*

P. L. Moldawa in the Bannat; Tajowa in Lower Hungary; Kapnik, Transylvania; Felsobanya, &c.; chiefly in primitive rocks.

Appendix to Section 5.

BISMUTH BLENDE. (PHILLIPS.) SILICATE OF BISMUTH.

H.=3·5—4·0; Sp. gr. 5·9—6·0; C. dark-brown, or yellow; Sk. yellowish-grey. It occurs in very small globular masses, and also in minute trigonal dodecahedrons.

Before the blow-pipe it decrepitates, gives out an arsenical odour, and melts into a glass.

C. P. Silica 22·23, oxide of bismuth 69·38, oxide of iron 2·40, oxide of manganese 0·30, phosphoric acid 3·31, water, &c. 1·01, *Kersten.*

L. Schneeberg in Saxony, with native bismuth, and ores of cobalt.

Note.—I have been unable to obtain any specimens of this substance for examination. The above description is taken from the fourth edition of

'Phillips's Mineralogy,' being one of Mr Allan's additions. It was formerly termed arsenical or arseniated bismuth, and from its yielding an alliacious odour before the blow-pipe, it must be generally rendered impure by an admixture of arseniuret of cobalt, or other arsenical ores, at least if the phosphoric acid of the above analysis be not in part combined with arsenic acid.

SECTION 6.

A.

Remarks.—As this group (A) of the present Section contains a greater number of mineral substances than any other in the volume, it is, for the sake of easy reference, divided into four subordinate groups, as follows:—

- Group 1. Comprising those substances which are fusible before the blow-pipe into a metallic globule, or reducible either alone or with the fluxes.
- Group 2. Comprising those substances which, when fused with Borax, form a glass that turns opaque on cooling, or by flaming.
- Group 3. Comprising those substances which are fusible with intumescence, or with bubbling (generally into a blebby glass).
- Group 4. Comprising those substances which are fusible without intumescence or bubbling (generally into a clear glass).

Group I.

EXITELITE. OXIDE OF ANTIMONY.

Exitèle, Beud.; Oxide of Antimony, *Phil.*; Prismatic Antimony Baryte, *M.*; White Antimony.

H.=2·5—3·0; Sp. gr. 5·5—5·6; C. white, grey, sometimes stained reddish, &c.; Sk. white; L. pearly or adamantine. It occurs in small tabular or acicular crystals, the latter forming divergent groups; more rarely massive. P. F. a right rhombic prism of 137° 43', and 42° 17'.

Fusible and volatilizable before the blow-pipe; on charcoal reducible, colouring the flame green.

C. P. Oxygen 15·68, antim. 84·32, *Berz.*

P. L. Braunsdorf, Saxony; Przibram, Bohemia; Dauphiné, &c.

CHLORIDE OF MERCURY.

Calomel, Beud.; Muriate of Mercury, *Phil.*; Pyramidal Pearl Kerate, *M.*

H.=1·5—2·0; Sp. gr. 6·4—6·5; C. and Sk. greyish-white, sometimes tinged greenish, &c.; sectile. It occurs in crusts and minute prisms with square bases (fig. 39, 51, 53, 54).

Entirely volatilizable; with soda it gives numerous globules of mercury; when fused with salt of phosphorous and oxide of copper, it imparts a deep blue colour to the flame.

C. P. Chlorine 14·89, mercury 85·11, *Berz.*

P. L. Almaden in Spain, Idria in Carniola, and particularly Moschel-Landsberg in Deux-Ponts, with cinnabar, &c.; but as yet it is a rare mineral.

KERARGYRITE. CHLORIDE OF SILVER.

Kerargyre, Beud.; Muriate of Silver, *Phil.*; Hexahedral Pearl Kerate, *M.*

H.=1·0—2·0; Sp. gr. 5·5—6·0; C. white, grey (sometimes stained blue or green*), externally brownish; Sk. staining and resinous;

* Bromide of silver?

malleable and sectile. It occurs in flakes, in granular concretions, and crystallized in small cubes and acicular prisms. P. F. the cube.

Not volatilizable; fusible, and reducible into a globule of silver. If rubbed with a little water on a polished surface of copper, it will cover it with a thin metallic coating.

C. P. Chlorine 24, silver 76, *Klapr.*

P. L. Peru, and Mexico; Freyberg, &c., in Saxony; Siberia; Cornwall, in primitive rocks, with other ores of silver.

Note.—An earthy variety of chloride of silver mixed with a large proportion of argillaceous matter, occurs in transition rocks at Andreasberg in the Hartz. It has been named Buttermilk-silver, and is of a grey or brownish white colour, opaque, and dull, occurring massive or investing other substances. Before the blow-pipe on charcoal it yields a slaggy mass, containing minute globules of reduced silver.

COTUNNITE. CHLORIDE OF LEAD, FROM VESUVIUS.

Id. Phil. (Allan's Manual); *Id. Kobell.*

H. about 1·5; C. white; slowly soluble in water.

See Sec. 1 of this Division.

MENDIPITE. CHLORIDE OF LEAD, FROM SOMERSETSHIRE.

Muriate of Lead, *Phil.*; Peritomous Lead Baryte, *M.*; Berzelite, *Levy.*

H.=2·5—3·0; Sp. gr. 7·0—7·1; C. white, reddish, &c. It occurs in crystalline masses of a fibrous (often radiated) structure. P. F. a right rhombic prism of $102^{\circ} 27'$ and $77^{\circ} 33'$.

Fusible, and reducible on charcoal; with salt of phosphorus and oxide of copper it colours the flame blue.

C. P. Chloride of lead 34·63, oxide of lead 55·82, carbonate of lead 7·55, silica 1·46, water 0·54, *Berz.*

L. Churchill in the Mendip Hills, Somersetshire, on the earthy variety of manganite.

MATLOCKITE. CHLORIDE OF LEAD, FROM DERBYSHIRE.

Kerasine, *Beud.*; Murio-Carbonate of Lead, *Phil.*; Horn-lead; Brachytypous Lead Baryte, *M.*

H.=3·0; Sp. gr. 6·0—6·1; C. white, grey, yellow. It occurs in rectangular four-sided prisms (the primary form), simple, or truncated on the edges.

Fusible, and on charcoal reducible; in other respects it behaves like the preceding.

C. P. Chlorine 13·10, lead 37·61, oxide of lead 12·89, carbonate of lead 36·40, *Klapr.*

P. L. Cromford Level, near Matlock, in Derbyshire; Badenweiler (?), in Germany.

ANGLESITE. SULPHATE OF LEAD.

Anglesite, *Beud.*; Sulphate of Lead, *Phil.*; Prismatic Lead Baryte, *M.*

H.=3·0; Sp. gr. 6·2—6·31; C. white, grey, also stained blue, green, or yellowish. It occurs massive, in granular concretions, and crystallized (fig 185, 186, 188, 193). P. F. a right rhombic prism of $103^{\circ} 42'$ and $76^{\circ} 18'$.

Fusible into a milky globule, which is reduced with effervescence in the R. F. on charcoal.

C. P. Sulphuric acid 24·8, protoxide of lead 71·0, water 2·0, oxide of iron 1·0, *Klapr.*

P. L. Anglesea; Leadhills and Wanlockhead in Scotland; Cornwall; Zellerfeld and Clausthal in the Hartz; Siberia, &c., with galena, and other ores.

LANARKITE. SULPHATO-CARBONATE OF LEAD.

Lanarkite, *Beud.*; Sulphato-Carbonate of Lead, *Phil.*; Prismatoidal Lead Baryte, *Haid.*

H.=2·5; Sp. gr. 6·8—7·0; C. grey, greenish-white, yellow. It occurs in lamellar concretions and small indistinct prisms aggregated lengthways. P. F. a right rhombic prism of $59^{\circ} 15'$ and $120^{\circ} 25'$ (Brooke).

Soluble in nitric acid with a scarcely perceptible effervescence, leaving a residue of sulphate of lead.

Fusible, and reducible on charcoal.

C. P. Carbonate of lead 46·9, sulphate of lead 53·1, *Brooke.*

P. L. Leadhills in Scotland, with the pyromorphite, &c.

CALEDONITE. CUPREOUS SULPHATO-CARBONATE OF LEAD.

Caledonite, *Beud.*; Cupreous Sulphato-Carbonate of Lead, *Brooke, Phil.*; Paratamous Lead Baryte, *Haid.*

H.=2·5—3·0; Sp. gr. 6·4; C. bright bluish-green; Sk. greenish-white. It occurs crystallized (fig. 157); the crystals are sometimes very small, and form radiating groups. P. F. a right rhombic prism of 95° and 85° . Soluble in nitric acid with feeble effervescence, leaving, like the preceding, a residue. C. of solution, bluish-green, turning blue on the addition of ammonia.

C. P. Carbonate of lead 32·8, carbonate of copper 11·4, sulphate of lead 55·8, *Brooke.*

P. L. Leadhills in Scotland, with the Lanarkite, &c.

MELINOSE. MOLYBDATE OF LEAD.

Melinose (*μελινος*, pale-yellow), *Beud.*; Molybdate of Lead, *Phil.*; Pyramidal Lead Baryte, *M.*

H.=3·0; Sp. gr. 6·6—6·9; C. yellow, grey, brownish, rarely yellowish-red; L. resino-adamantine. It occurs massive, cellular, in coatings, and most commonly crystallized (fig. 36 to 39, 61 to 63). P. F. the octahedron with square base.

Before the blow-pipe it decrepitates, fuses, and yields globules of lead. With borax it gives in the R. F. a transparent glass, which on cooling becomes of a dark-brownish colour, and nearly opaque. With salt of phosphorus it forms (if in small quantity) a fine green glass, which, when saturated, becomes black and opaque.

C. P. Molybdic acid 34·25, oxide of lead 64·42, *Klapr.*

P. L. Bleiberg in Carinthia; Moldawa in the Bannat, &c., in metalliferous repositories, with other ores of lead.

SCHEELITINE. TUNGSTATE OF LEAD.

Scheelitine, *Beud.*; Tungstate of Lead, *Phil.*; Scheelsaures Blei, *Leonhard.*

H.=3·0; Sp. gr. 8·0—8·2; C. yellowish, or greenish-grey; L. resinous. It occurs in very small four-sided prisms grouped together. P. F. a rectangular four-sided prism.

Fusible into a dark-grey semi-metallic globule. With borax it gives in the R. F. a yellowish glass, which on cooling becomes grey and opaque, but if the lead be first driven off, the glass on cooling remains transparent, and takes a dark red tinge. With soda, on charcoal, it yields globules of reduced lead.

C. P. Tungstic acid 51·72, oxide of lead 48·28, *Lampadius.*

P. L. Zinwald in Bohemia, with quartz and mica.

JOHNSTONITE. VANADIATE OF LEAD.

Vanadate of Lead, *Phil.*

H. about 3·0—4·0; Sp. gr. 6·9—7·25; C. yellow, reddish-brown; dull, opaque. It occurs in small globular masses, and rarely in indistinct six-sided prisms.

Fusible, and reducible on charcoal into a grey metallic globule, which imparts to glass of borax a greenish colour.

Soluble in nitric acid, solution yellow; in muriatic and sulphuric acids, solution green.

C. P. Vanadate of lead 74·00, chloride of lead 25·33, hydrous oxide of iron 0·67, from Zimapan, *Berz.*

P. L. Zimapan in Mexico; Beresof in Siberia, with the Pyromorphite; Wanlockhead in Dumfriesshire, with the Smithsonite.

PLOMBGOMME. ALUMINATE OF LEAD.

Plombgomme, *Beud.*; Plombgomme, *Phil.*

H.=4·0—5·0; Sp. gr. 6·4—6·5; C. yellow, yellowish or reddish-brown. It occurs in reniform masses resembling gum.

Gives off water in the matrass, decrepitating, and becoming white and opaque.

Before the blow-pipe it swells up with intumescence, but remains in a semi-fused state. With soda it yields numerous globules of lead.

C. P. Alumina 37·00, oxide of lead 40·14, water 18·80, lime, with the oxides of iron and manganese, 1·80, silica 0·60, sulphuric acid 0·20, *Berz.*

L. Huelgoet in Brittany, in clay-slate with galena, zinc-blende, and iron-pyrites.

PYROMORPHITE. PHOSPHATE OF LEAD.

Pyromorphite (*πυρ*, fire, *μορφή*, form, crystallizing by fusion) *Beud.*; Phosphate of Lead, *Phil.*; Rhombohedral Lead Baryte (in part), *M.*

H.=3·5—4·0; Sp. gr. 6·9—7·1; C. green, yellow, grey, brown. It occurs massive, reniform, &c., and crystallized (fig. 93, 98, 99, 105, 106, 112, 116, 121, 123). P. F. the regular six-sided prism.

Before the blow-pipe, on charcoal, it fuses into a brownish or yellowish globule, which on cooling crystallizes with the evolution of light, presenting broad facets. With the fluxes it is reduced.

C. P. Phosphoric acid 15·727, protoxide of lead 74·216, chloride of lead 10·054. *Wöhler.*

P. L. Zschopau in Saxony; Mies and Przibram in Bohemia; Huelgoet in Brittany; Cornwall; Leadhills, &c., in primitive and secondary rocks, chiefly accompanying galena and other ores of lead.

VIVIANITE. PHOSPHATE OF IRON.

Phosphate de Fer, *Beud.*; Phosphate of Iron, *Phil.*; Prismatic Iron Mica, *M.*; Vivianit, *W.*

H.=2·0, if not in an earthy state; Sp. gr. 2·6—2·7; C. blue, greenish, brownish, and almost white; the Sk. changes very soon, on exposure to the air, to blue. It occurs massive, disseminated, in an earthy state, in fibrous concretions and small crystals (fig. 219 a). P. F. a right oblique-angled prism.

Before the blow-pipe it intumesces, reddens, and fuses readily into a steel-grey globule, which is attractable by the magnet.

In the matrass the Vivianite gives off a large quantity of water.

C. P. Phosphoric acid 31·18, protoxide of iron 41·23, water 27·49, from Cornwall, *Strom.*

P. L. Cornwall (near St Agnes); Derbyshire; Bodenmais in Bavaria (in gneiss with sulphuret of iron); Transylvania; Anglar (Anglarite of Kobell) in the Hante Vienne, France; Brazil; New Jersey, &c.

The earthy variety has been found in the mud of the Thames, at the Isle of Dogs; also in river mud near Liverpool; in Corinthia; New Jersey, &c. It is often white when first found, but changes quickly to blue, or greyish-green.

Appendix to the Vivianite.

KARPHOSIDERITE.

Id. Phil.

H.=4.0—4.5; Sp. gr. 2.5; C. straw-yellow; L. resinous; feels greasy. It occurs in reniform masses.

Fusible into a black magnetic globule.

C. P. Phosphoric acid, iron, and water.

L. Labrador.

It was distinguished and named by Breithaupt.

TRIPLITE. PHOSPHATE OF MANGANESE AND IRON.

Triplite, *Beud.*; Phosphate of Manganese, *Phil.*; Phosphormangan.

H.=5.0; Sp. gr. 3.4—3.9; C. brownish-black; Sk. yellowish-grey (or brown). It occurs massive. P. F. as obtained by cleavage, a rectangular prism.

Fusible with bubbling into a metallic-looking and highly-magnetic globule, though some varieties are by no means so easily fusible as this substance is generally represented to be. With soda the green colour indicative of manganese is developed.

C. P. Phosphoric acid 32.78, protoxide of manganese 32.60, phosphate of lime 3.20, *Berz.*

P. L. Near Limoges in France, in granite with coarse beryl; also WASHINGTON, Connecticut, and Sterling, Massachusetts, N. A.

Appendix to the Triplite.

HUREAULITE.

Id. Beud., Phil.

H. about 3.5; Sp. gr. 2.27; C. reddish-yellow. It occurs in minute translucent crystals derived from an oblique, rhombic prism of $117^{\circ} 30'$ and $62^{\circ} 30'$, and in other respects it resembles the Triplite.

C. P. Phosphoric acid 38.0, protoxide of manganese 32.85, protoxide of iron 11.10, water 18.0, *Dufresnoy.*

P. L. The quarries of Hureaux, and near Limoges in France.

HETEROSITE.

Id. Beud.; Phil.

H. about 5.0; Sp. gr. 3.52; C. bluish or greenish-grey; L. resinous. It occurs massive.

P. F. An oblique rhombic prism of 101° and 79° . In other respects it resembles the above.

C. P. Phosphoric acid 41.77, protoxide of iron 34.89, protoxide of mang. 17.57, water 4.40, silica 0.20, *Dufresnoy.*

It occurs with the above. Its name is derived from the Greek word *στέρος*, different.

Group II.

GLAUBERITE.

Taste, feebly saline; partly soluble in water; H.=2.5.

See Section 1 of this Division.

POLYHALLITE.

Id. Phil.; Polyhallite de Ischel, *Beud.*

Taste, very faintly bitter; scarcely acted upon by water; $H.=2.5-3.0$; Sp. gr. 2.77; C. brick or flesh-red. It occurs massive, and in parallel and curved fibrous concretions.

Fusible in the flame of a candle. Gives the reactions of sulphur when fused with soda and silica.

C. P. Hydrrous sulphate of lime 28.45, anhydrous sulphate of lime 22.42, anhydrous sulphate of magnesia 20.03, sulphate of potassa 27.70, chloride of sodium 0.19, red oxide of iron 0.34, *Strom.*

P. L. Ischel and Aussee in Upper Austria (with rock-salt); Hall in the Tyrol.

GYPSUM, OR SELENITE. SULPHATE OF LIME.

Gypse, *Beud.*; Gypsum, *Phil.*; Prismatic Gypsum Haloide, *M.*

$H.=1.5-2.0$; Sp. gr. 2.2—2.4; C. white, grey, also stained yellow, red, violet, &c.; flexible in thin pieces; L. pearly. It occurs massive, dentiform, in lamellar, granular, and fibrous (*satin gypsum*) distinct concretions, and crystallized (fig. 213, 213 a, 214). It also occurs in an earthy state. P. F. a right oblique angled prism of $113^{\circ} 08'$ and $66^{\circ} 52'$.

Gives off water in the matrass, becoming white and opaque, which it likewise does in the flame of a candle.

Before the blow-pipe it exfoliates, and fuses into a white enamel.

Gives the reactions of sulphur when fused with soda and silica.

C. P. Sulphuric acid 46.0, lime 33.0, water 21.0, *Bucholz.*

P. L. Bex in Switzerland, Hall in the Tyrol (with rock-salt); Sicily (in the sulphur mines); Shotover Hill near Oxford, Derbyshire, Yorkshire, &c., Montmartre near Paris, and numerous other places.

ANHYDRITE. ANHYDROUS SULPHATE OF LIME.

Karstenite, *Beud.*; Anhydrite, *Phil.*; Prismatic Gypsum Haloide, *M.*

$H.=3.0-3.5$; Sp. gr. 2.6—3.0; C. white, sometimes stained reddish, &c.; T. 2, 3, 4. It occurs massive, reniform, and contorted (the *pierre des tripes*), in lamellar, granular, and fibrous concretions, and rarely crystallized (fig. 140). P. F. a right rectangular prism.

Easily fusible into a white enamel. With soda and silica (or even with borax) it gives the reactions of sulphur.

C. P. Sulphuric acid 56.0, lime 39.0, baryta 2.0, silica 0.2, *Beudant.*

P. L. Hall in the Tyrol; Bex in Switzerland; Aussee, Upper Austria; Bleiberg, Carinthia; Bochnia in Poland; Vulpino in Italy,—chiefly accompanying rock-salt, in secondary rocks. It is also said to occur at New York.

CELESTINE. SULPHATE OF STRONTIA.

Celestine, *Beud.*, *Phil.*; Prismatic Hal Baryte, *M.*

$H.=3.0-3.5$; Sp. gr. 3.6—4.0; C. white, grey, blue, yellow, reddish. It occurs massive, stalactitic, in granular and fibrous concretions, and crystallized (fig. 175, 189). P. F. a right rhombic prism of 104° and 76° .

Before the blow-pipe it decrepitates, and melts easily into a white enamel, which possesses a nauseous and burning taste. With soda and silica it gives the reactions of sulphur.

See *Note* at the end of the following species.

C. P. Sulphuric acid 43.64, strontia 56.36, *Beudant.*

P. L. The sulphur mines of Sicily; Bex in Switzerland; Conilla in Spain; Strontian Island in Lake Erie; near Bristol; in Yorkshire; at Dornberg near Jena; in Pennsylvania, &c. In secondary and tertiary rocks with gypsum, sulphur, and other minerals, more rarely in basaltic or trap-rocks, and never in metalliferous veins or repositories, in which barytine so commonly occurs.

BARYTINE. SULPHATE OF BARYTA.

Barytine, *Beud.*; Barytes, *Phil.*; Prismatic Hal Baryte, *M.* Heavy-spar.

H.=3·0—3·5; Sp. gr. 4·1—4·7; C. white, grey, red, yellow, blue, &c. It occurs massive, in lamellar, granular, and fibrous concretions, reniform, globular, in an earthy state, and crystallized (fig. 141, 154, 156, 158, 159, 162, 163, 164, 165, 166, 167, 188, 189, 190, 191, 192, and 193). P. F. a right rhombic prism of $101^{\circ} 42'$ and $78^{\circ} 18'$.

Before the blow-pipe it decrepitates violently, and fuses rather difficultly into a white enamel, which possesses a nauseous and burning taste. With soda and silica it gives the reactions of sulphur.

C. P. Sulphuric acid 34·37, baryta 65·63, *Beud.*

P. L. Dufton in Cumberland; in Auvergne, France; Saxony, Bohemia, Hungary, Spain, Italy, Norway, &c. &c., generally in metalliferous veins with ores of lead, silver, iron, mercury, and other metals, in primitive and secondary rocks.

Note.—If the fused globule of Barytine, as obtained before the blow-pipe, be dissolved in a little nitric acid, and water added to the solution, a precipitate will be caused in it by sulphuric acid, however largely it may be diluted; whereas if Celestine be treated in a similar manner, sulphuric acid will cease to cause a precipitate in the solution on the addition of a large proportion of water. Barytine possesses likewise a higher specific gravity than celestine, the former averaging usually 4·45 or 4·6, whilst the latter is most commonly about 3·7; the degrees of fusibility, and the very different geological situations of the two minerals, may likewise serve to keep them from being confounded together.

WITHERITE. CARBONATE OF BARYTA.

H.=3·0—3·5; Sp. gr. 4·2—4·4; effervesces feebly in cold, but briskly in warm acids.

See Sec. 2 of this Division.

CRYOLITE. FLUORIDE OF ALUMINIUM AND SODIUM.

Cryolite, *Beud.*; *Id. Phil.*; Prismatic Cryone-Haloide, *M.*; Eisstein.

H.=2·5—3·0; Sp. gr. 2·96—2·98; C. white, sometimes stained yellow or brown by the hydrous peroxide of iron; translucent, transparent after immersion in water. It occurs in lamellar concretions. P. F. (as demonstrated by cleavage) a rectangular prism.

Fusible in the flame of a candle. Before the blow-pipe it melts immediately into a transparent globule, which on cooling becomes opaque. In an open glass tube of small diameter (the flame being directed upon it within the tube), it gives off a moisture which strongly corrodes the glass.

C. P. Fluorine 54·07, aluminium 13·00, sodium 32·93, *Berz.*

L. Arksut-fiord in West Greenland, with galena, iron pyrites, &c., in veins in gneiss.

FLUOR SPAR. FLUORIDE OF CALCIUM.

Fluorine, *Beud.*; Fluor-Spar, *Phil.*; Octahedral Fluor-Haloide, *M.*

H.=4·0; Sp. gr. 3·0—3·3; of all colours, chiefly white, violet, green, yellow. It occurs massive, in very small and closely united granular concretions (*Compact Fluor*, which is devoid of regular cleavage), in an earthy state (*Earthy Fluor*) in lamellar and prismatic concretions, stalactitic (rare), and often

crystallized (fig. 8 to 15, 20 to 26, 28, 29, and 30). P.F. The regular octahedron.

Fusible in a good heat into a white enamel. In the matrass, or on charcoal when first exposed to the flame, it decrepitates violently. Its powder placed on a live coal becomes phosphorescent, usually emitting a greenish or purple light. *For other characters, see the "Fluorides," Chapter III.*

C. P. Fluorine 48.13, calcium 51.87; *Berz.*

P. L. Cumberland, Derbyshire, Cornwall, Devonshire; Mont Blanc and St Gothard; Zinnwald in Bohemia; Norway; Siberia, &c., in primitive and secondary rocks (generally in metalliferous veins and deposits), more rarely in tertiary strata (the "calcaire grossier" of the environs of Paris), and in amygdaloidal and volcanic rocks.

APATITE. PHOSPHATE OF LIME.

Id. Beud., Phil.; Rhombohedral Fluor Haloide, *M.*

H.=5.0; Sp. gr. 3.0—3.3; P.F. a regular six-sided prism.

Before the blow-pipe, if in a thin splinter, it becomes (in some varieties) rounded on the edges into a clear glass, but is otherwise infusible *per se*.

See Section 7, A, of this Division.

Group III.

KARPHOLITE.

Id. Phil.; Carpholite, *Beud.*; Strohstein, *W.*

H.=1.5; Sp. gr. 2.93—2.94; C. yellow. It occurs in radiated fibrous concretions, and in minute imperfect crystals grouped together. It is also sometimes found in an earthy state.

Fusible with bubbling into a brown enamel, which imparts strongly to soda the green colour indicative of manganese.

In the matrass it gives off water and fluoric acid, which attacks the glass and turns Brazil-wood paper yellow.

C. P. Silica 36.154, alumina 26.669, protoxide of manganese, 19.160, protoxide of iron, 2.290, lime 0.271, fluoric acid 1.470, water 10.780, *Strom.*

P. L. Schlackenwalde in Bohemia, in granite with quartz and fluor-spar.

WEBSTERITE.

Sub-sulphate of Alumina.

H.=2.0 and less; Sp. gr. 1.66—1.67; C. white. It occurs massive.

Before the blow-pipe it intumescs or curls up into a white, ramified, and friable mass, which glows with an intensely white light, but resists further fusion.

See Sec. 7, A, of this Division (Group 3).

CHLORITE AND TALC.

Id. Beud., Phil.; the Prismatic Talc-Mica of Möhs.

H.=1.0—1.5; Sp. gr. 2.6—2.8; C. green, white.

The white varieties are infusible; the light-green and green varieties always whiten, and generally fuse on their extreme edges; some of the dark-green varieties fuse in a good heat, with slight bubbling into a black shining glass. See Sec. 7, A, of this Division.

MICA AND LEPIDOLITE.

Id. Beud., Phil.; the Rhombohedral and Hemi-prismatic Talc-Micas of Möhs.

H.=1.5—2.5, but the edges of the laminae scratch glass; Sp. gr. 2.7—3.0; C. white, green, brown, grey, black (Mica), red, grey, (Lepidolite) sectile; elastic in thin folia. It occurs massive, in thin laminar concretions, and in six-sided tabular crystals.

Before the blow-pipe many varieties fuse easily, and with bubbling, into a black or yellowish glass or enamel, the surface of which is sometimes shining, but very often dull. Other varieties merely become white and opaque, and remain infusible, or fuse only on their extreme edges. The Lepidolite fuses with great ease, and continued bubbling into a blebby colourless glass.

Constituent Parts.

1. Mica, from Siberia, possessing only one axis of double refraction, by *Rose*.
2. Mica from Uto, by *Rose*.
3. Greenish Mica from Altenberg, by *Turner*.
4. Grey Mica from Cornwall, by *Turner*.
5. Lepidolite from Rozena, by *Gmelin*.

	1	2	3	4	5
Silica - - - - -	42.01	47.50	40.19	50.82	49.060
Alumina - - - - -	16.05	37.20	22.72	21.33	33.611
Potassa - - - - -	7.55	9.60	7.49	9.86	4.186
Magnesia - - - - -	25.97	—	—	—	0.408
Lithia - - - - -	—	—	3.06	4.05	3.592
Peroxide of Iron - - - - -	4.93	3.20	19.78	9.08	—
Oxide of Mang. - - - - -	—	0.90	2.02	—	1.402
Fluoric Acid - - - - -	0.68	0.56	3.99	4.81	8.445
Phosphoric Acid - - - - -	—	—	—	—	0.112
Water - - - - -	—	2.63	—	—	4.184
					{ with loss.

P. L. Various parts of Great Britain, France, Switzerland, Hungary, Bohemia, Norway, Siberia, America, &c., &c., forming part of the oldest primitive rocks, such as granite, gneiss, and mica-chist, also disseminated in sand-stones and slates.

It likewise occurs in the lavas and ejected rocks of Vesuvius and other volcanoes, as well as in trap and basaltic rocks.

Note.—As it cannot be correct to unite under one species, minerals which behave in a totally different manner before the blow-pipe (this behaviour being necessarily most intimately connected with their constituent parts), so it must certainly follow (as borne out by the above and numerous other analyses) that the present substance, Mica, ought to be divided into several perfectly distinct species. Now, this has been done by Möhs, and also, in a certain degree, by Berzelius, but in neither instance in a sufficiently satisfactory manner. The former divides it as a genus (Talc-Mica), into three species: Prismatic, Rhombohedral, and Hemi-prismatic Talc-Mica, of which the first refers to Chlorite and Talc. Berzelius forms also three divisions of Mica (not including Chlorite or Talc); Magnesia-Mica, Potassa-Mica, and Lithia-Mica. The first of these (Magnesia-Mica) agrees with the Rhombohedral Talc-Mica of Möhs, and contains only one axis of double refraction, the two others contain each two axes of double refraction, and are included in the Hemi-prismatic Talc-Mica, of Möhs. It will probably be found that those specimens which fuse easily and perfectly before the blow-pipe contain lithia, and belong therefore to the last division of Berzelius, of whatsoever colour or aspect they may happen to be. In regard to the fusibility of the other

divisions, nothing definite can at present be stated; but it may be mentioned that the small dark-green crystals, which occur amongst the ejected matters of Vesuvius, and which are usually given to the Rhombohedral or Magnesia-Mica division, fuse difficultly on the edges, with very slight bubbling, into a white blebby glass. Whether this be characteristic of the division or not, I cannot at present say, as I have not had an opportunity of examining a sufficient number of accurately-defined specimens; but I am convinced that, were the various kinds of Micæ divided carefully into several species, according to their constituent parts, the blow-pipe alone would present easy means of distinguishing them from each other.

RUBELLANE.

Id. Beud., Phil.

H.=1·5—2·0; Sp. gr. 2·5—2·7; C. reddish-brown, pale reddish-grey in the powder. It occurs in hexahedral prisms of a laminar structure, the laminae not flexible.

Before the blow-pipe it fuses readily and with bubbling into a dark-green or black enamel, attractable by the magnet.

C. P. Silica 45, alumina 10, oxide of iron 20, lime 10, potassa and soda 10, volatile matter 5, *Klapr.*

P. L. Schima in the Mittelgebirge, and Boreslau, near Toplitz, Bohemia, imbedded in an amygdaloidal rock, with augite, &c.

Note.—It has been regarded as a mica altered by heat, but if the quantity of lime in the above analysis be correct, it must be considered as a distinct species. It is probably to this quantity of lime, in conjunction with the silica and alumina, that its easy fusion and bubbling may be attributed.

FAHLUNITE.

Id. Phil.; Tricklasite, Beud.; Fahlnite tendre.

H.=3·0; Sp. gr. 2·6—2·7; C. reddish-brown, more rarely green or black; T. 0 or 2; L. resino-vitreous. It occurs massive, but more often in six-sided prisms, which are usually broken. P. F. an oblique rhombic prism of 109° 28' and 70° 32' (*Phil.*), or of 109° 30' and 70° 30' (*Beud.*); inclination of the base on the axis 101° 30'.

Before the blow-pipe it immediately becomes quite white and opaque, fusing without difficulty on the edges, and with bubbling at intervals, into a white enamel or very blebby glass. In a good blast the fusion is rendered perfect.

C. P. Silica 46·79, alumina 26·73, water 13·50, magnesia 2·97, oxide of iron 5·01, oxide of manganese 0·43, *Hisinger.*

L. Fahlun in Sweden, at the copper mine of Eric Matts, imbedded in talc or chlorite slate.

ALLOPHANE.

Id. Beud., Phil.

H.=3·0; Sp. gr. 1·8—1·9; C. pale blue, greenish, brownish, white. Before the blow-pipe it intumesces and becomes friable, but does not fuse.

See Sec. 7, A, of this Division.

SCHILLER SPAR.

Id. Phil.; Diallage (in part) Beud.; Diatomous Schiller Spar, M.

H.=3·5—4·0; Sp. gr. 2·6—2·8; C. green, more rarely pinchbeck-brown; L. 3, 4, metallic-pearly, metallic in certain directions; opaque. It occurs disseminated and in granulo-laminar concretions. Cleavage, highly perfect in one direction, indistinct in another; the junction of the two forming an angle of about 135°.

Before the blow-pipe it is difficultly fusible with bubbling into a greenish-grey, or yellowish enamel, but if the assay be larger than a very thin splinter, it will only fuse on the edges.

C. P. Silica 43·900, magnesia 25·856, protoxide of iron 13·021, protox. of mang. 0·535, lime 2·642, water 12·426, *Kohler*.

P. L. Basto in the Hartz, in greenstone, &c; the Shetland Isles (?).

STILBITE.

Id. Beud., Phil.; Prismatic Kouphone Spar, *M.*; Radiated Zeolite.

H.=3·5—4·0; Sp. gr. 2·0—2·2; C. white, grey, red, brown. It occurs in granular and radiated prismatic concretions (sometimes forming semi-globular masses), and crystallized (fig. 142, 145, 149, 187*a*, and 189). P. F. a right rectangular prism, fig. 139.

Before the blow-pipe it intumesces (curls up like borax), and then fuses slowly without bubbling into a very blebby white glass. In the matrass, gives off water.

C. P. Silica 58·0, alumina 16·10, lime 9·2, water 16·4.

P. L. Iceland and the Faroe Isles; Indore in the Vendayah Mountains, Hindostan; Val di Fassa, Tyrol; Arendal, Norway; Dumbartonshire; Andreasberg in the Hartz, &c., principally in trap rocks; but at Arendal, Andreasberg, and some other localities, it occurs in metalliferous veins, in primary rocks.

HEULANDITE.

Id. Beud., Phil.; Hemi-prismatic Zeolite, *M.*; Foliated Zeolite.

H.=3·5—4·0; Sp. gr. 2·0—2·2; C. white, grey, yellowish, brown, red. It occurs in granular and lamellar concretions, globular, and crystallized (fig. 203). P. F. a right oblique-angled prism (130°).

Before the blow-pipe its comportment resembles that of Stilbite.

C. P. Silica 59·90, alumina 16·83, lime 17·19, water 13·43, *Walmstedt*.

P. L. The same as those of Stilbite, although the two minerals rarely occur together in the same cavity.

SPHEROSTILBITE.

Id. Beud., Phil.

H. about 3·5, but on the surface it yields to the nail; Sp. gr. 2·31; C. white or greyish; L. pearly. It occurs in small globular masses, composed of thin or flat radiated concretions which are more or less flexible, and brilliant in the fracture.

Fusible with intumescence. In acids it forms a jelly.

C. P. Silica 55·91, alumina 16·61, lime 9·03, soda 0·68, water 17·84, *Beud.*

P. L. Iceland and the Faroe Isles in trap rocks, with Stilbite, &c.

Note.—It was first distinguished by Beudant, and appears to be closely allied to the Mesole. See below.

HYPOSTILBITE (BEUDANT).

A white substance in dull globules, composed of delicate fibres, or compact, and without any lustre in the fracture; Sp. gr. 2·14.

Does not scratch glass.

Difficultly fusible on the edges, frothing a little, and becoming rough on the surface. Soluble in acids without forming a jelly.

C. P. Silica 52·43, alumina 18·32, lime 8·10, soda 2·41, water 18·70, *Beud.*

It occurs with the Stilbite, Epistilbite, and Spherostilbite in the Faroe Isles.

Note.—The above description is translated from the 'Minéralogie' of Beudant.

EPISTILBITE.

Id. Beud., Phil.; Diplogenic Kouphone, Spar.

H.=4.0—4.5; Sp. gr. 2.2—2.25; C. white, grey, yellowish. It occurs crystallized (fig. 215 a). P. F. a right rhombic prism of $135^{\circ} 10'$ and $44^{\circ} 50'$.

Before the blow-pipe its comportment resembles that of Stilbite.

C. P. Silica 58.59, alumina 17.52, lime 7.56, soda 1.78, water 14.0, *Rose*.

P. L. The Faroe Isles, with Stilbite and other zeolitic minerals.

MESOLE.

Id. Phil.; Flabelliform Kouphone Spar, *Haid*.

H.=3.5; Sp. gr. 2.3—2.4; C. white, grey, yellowish. It occurs in globular masses composed of radiated flat prismatic concretions, which are flexible and somewhat elastic.

Fusible with previous intumescence.

C. P. Silica 42.60, alumina 28.00, lime 11.43, soda 5.63, water 12.70, *Berz*.

P. L. Iceland and Nalsoe in the Faroe Isles, with various zeolitic minerals.

KEROLITE, OR CEROLITE.

Id. Breith., Beud., Phil., &c.; Hydrosilicite.

H. about 2.0, according to Allan, &c., but in the specimens which I have examined it was as high as 3.5; Sp. gr. 2.0—2.2; C. yellowish, white, greenish; L. waxy; T. 2, 3. It occurs in small masses (sometimes mammillated), which appear to have a more or less lamellar structure.

Per se, it fuses only on the edges and surface, into a colourless glass.

C. P. Silica 37.95, alumina 12.18, magnesia 16.02, water 31.00, *Pfaff*.

P. L. Frankenstein in Silesia, and Zöblitz in Saxony, in serpentine.

KILLINITE.

Id. Beud., Phil.

H.=4.0; Sp. gr. 2.65—2.75; C. light-green or yellowish-brown; L. 2 or 1. It occurs in semi-crystalline masses, yielding by cleavage a rhombic prism of 135° and 45° .

Fusible without intumescence (curling up), but with bubbling into a very blebby white glass.

C. P. Silica 52.49, alumina 24.50, potassa 5.00, oxide of iron 2.49, water 5.00, *Barker*.

L. Kilkenny in Ireland, in granite veins traversing mica-schist, with spodumene, feldspar, &c.

LEVYNE.

Id. Phil.; Macrotypous Kouphone Spar, *M*.

H.=4.0; Sp. gr. 2.0—2.2; C. white; semi-transparent; L. vitreous. It occurs crystallized (fig. 263). P. F. a rhombohedron of $100^{\circ} 31'$ and $79^{\circ} 29'$.

Before the blow-pipe it acts like chabasite. See below.

C. P. Silica 46.30, alumina 22.47, lime 9.72, soda 1.55, potassa 1.26, oxide of iron 0.77, oxide of manganese 0.19, water 19.51, *Connell*.

P. L. Iceland; Faroe Isles; Greenland and Glenarm, County Antrim, in trap rocks, with mesotype and other zeolitic minerals.

CHABASITE.

Chabasie, *Beud., Phil.*; Rhombohedral Kouphone Spar, *M*.

H.=4.0—4.5; Sp. gr. 2.0—2.1; C. white, sometimes pale red superficially; L. vitreous. It occurs only crystallized (fig. 2 and 84). P. F. an obtuse rhombohedron of $94^{\circ} 46'$ and $85^{\circ} 14'$.

Before the blow-pipe it intumescs (curls up) considerably, and

then fuses, without bubbling, into a very blebby white glass. Does not form a jelly in acids.

- C. P. Silica 50·65, alumina 17·90, lime 9·93, potassa 1·70, water 19·90, *Berz.*
 P. L. Iceland, the Faroe Isles, Greenland, Bohemia, Sweden, Scotland, &c., in trap rocks, with other zeolitic minerals, but rarely associated with them in the same cavity.

LAUMONITE.

Id. Beud., Phil. ; Diatomous Kouphone Spar, *M.* ; Efflorescent Zeolite.

H.=4·5 or 5·0, when fresh, but generally, from decomposition, it yields to the nail ; Sp. gr. 2·3—2·4 ; C. white, grey, reddish ; L. pearly ; very easily frangible. It occurs in granular distinct concretions, and crystallized in oblique rhomboidal prisms, simple or modified. P. F. an oblique rhomboidal prism of $113^{\circ} 30'$; and of $86^{\circ} 15'$ for the inclination of the terminal on the lateral planes.

Before the blow-pipe it intumesces, becomes translucent, and fuses, without bubbling, into a blebby glass. In acids it forms a jelly.

- C. P. Silica 48·3, alumina 22·7, lime 12·1, water 16·0, *Gmelin.*
 P. L. Huelgoet lead mine, in Brittany ; Iceland, the Faroe Isles, the Tyrol, various parts of Scotland and Ireland, Connecticut, &c., in trap rocks.

GMELINITE.

Id. Phil. ; Hydrolite, *Beud., Leman* ; Hexahedral Kouphone Spar, *Haid.*

H.=4·5 ; Sp. gr. 2·0—2·1 ; C. white, reddish ; L. vitreous. It occurs in small globular masses, and in crystals (fig. 137 *a*) derived from a rhombohedron.

Exposed to the flame of a candle, it immediately becomes opaque, and flies off in minute particles ; behaving in this respect like the Arragonite.

Before the blow-pipe it generally decrepitates, but if treated with caution, it fuses with slight intumescence into a blebby glass. Soluble in acids.

- C. P. Silica 50·00, alumina 20·00, lime 4·25, soda 4·25, water 20·00, *Vauq.*
 P. L. The Vincentine (Castel, and Montechio Maggiore). Also Glenarm in the County of Antrim, Ireland, and the Magee Island near Larne, in cavities of trap rocks.

THOMSONITE.

Id. Beud., Phil. ; Orthotomous Kouphone Spar, *M.*

H.=5·0 ; Sp. gr. 2·35—2·38 ; C. white ; L. pearly, vitreo-pearly. It occurs in thin radiated prismatic concretions, rarely distinctly crystallised (fig. 42, 44). P. F. a right rectangular prism with square base.

Before the blow-pipe it intumesces very much, and fuses on the edges, but the intumescence mass cannot be brought into a globule, or only with great difficulty. Forms a jelly in acids.

- C. P. Silica 38·30, alumina 30·20, lime 13·54, soda 4·53, magnesia 0·40, water 13·10, *Berz.*
 P. L. Kilpatrick, near Dumbarton, in Scotland ; the Faroe Isles ; with prehnite, heulandite, &c., in trap rocks.

COMPTONITE.

Id. Dr Brewster, Phil. ; Comptonitic Kouphone Spar, *Haid.*

H.=5·0—5·5 ; Sp. gr. 2·3—2·4 ; C. white ; L. vitreous. It occurs in small right rectangular prisms.

Before the blow-pipe it intumesces, gives off water, and fuses imperfectly into a blebby glass. Forms, when in powder, a jelly in acids.

P. L. Vesuvius in Lava, with Mesotype, &c.; Hauenstein in Bohemia.

Note.—It appears to be nearly allied to the Thomsonite, differing from that mineral chiefly in regard to the base of the primary prism, which, though rectangular, is not a square.

It may be here observed that a great number of those minerals which were formerly, and are still often, termed "Zeolitic," present the same characters when exposed to the action of the blow-pipe. This coincidence arises from the fact that they are compounds of the same elements, differing only in slight proportions, and this difference, affecting the primary form, has led to their division into numerous species, which might no doubt be carried on to an almost unlimited extent, for there are probably, in our best-arranged cabinets, massive or amorphous specimens, placed as varieties of Stilbite, Thomsonite, &c., which agree with those minerals in specific gravity, hardness, and general aspect, but which, if very closely examined as to cleavage, might be found to differ from them more or less, and consequently to form new species, in the usual acceptation of the term.

It may in like manner be supposed, that there occur massive or amorphous varieties of the Comptonite, Levyne, &c., which are confounded with other minerals of this class, not being in many instances recognizable, except by an accurate analysis.

SCOLEZITE.

Id. Beud.; Needlestone, Mesolite, *Phil.*; *Ædelite* (in part).

H.=5.0—5.5; Sp. gr. 2.2—2.3; C. white, greyish, reddish. It occurs in divergent and interlaced long acicular prisms, or prismatic concretions. P. F. a slightly-rhombic prism, agreeing closely with that of Mesotype.

Before the blow-pipe it turns opaque, and curls up exceedingly, finally melting into a very blebby white glass.

C. P. Silica 46.80, alumina 26.50, lime 9.87, soda 5.40, water 12.30 (from Faroe), *Berz.*

P. L. Iceland, the Faroe Isles, Greenland, Bohemia, Pargas in Finland, the Vendayah Mountains in Hindostan, &c., in trap rocks.

DAVYNE.

Id. Phil., Beud.; Davytic Kouphone Spar, *Haid.*

H.=5.0—5.5; Sp. gr. 2.3—2.4; C. white, yellowish, grey. It occurs in small crystals (fig. 106), which are modified six-sided prisms derived from a rhombohedron.

Before the blow-pipe it intumesces and fuses, without bubbling, into a very blebby glass. In the matrass it gives off much less water than Chabasite, Stilbite, &c., which behave like it before the blow-pipe. Forms a jelly in acids.

C. P. Silica 42.91, alumina 33.28, lime 12.02, iron 1.25, water 7.43, loss 3.11, *Covelli.*

P. L. Vesuvius, with mica, Wollastonite, &c.

BREWSTERITE.

Id. Brooke, Phil., and Beud.; Brewsteritic Kouphone Spar, *Haid.*

H.=5.0—5.5; Sp. gr. 2.1—2.4; C. white, grey, yellowish. It occurs in small crystals (fig. 205 a). P. F. an oblique rectangular prism.

Before the blow-pipe it curls up exceedingly, and then fuses perfectly into a glass, which, although blebby, is never sufficiently so, as to appear like an enamel. Forms a jelly in acids.

C. P. Silica 53·66, alumina 17·49, strontia 8·32, baryta 6·75, lime 1·34, water 12·58, oxide of iron 0·29, *Connell*.

P. L. Strontian in Argyleshire, with calc-spar; St Turpet, near Freiberg (Brigau); The Giant's Causeway, &c.

APOPHYLLITE.

Id. Beud., Phil.; Pyramidal Kouphone Spar, *M.*; Ichthyophthalmite; Albine; Tesselite.

H. = 4·5—5·0; Sp. gr. 2·2—2·5; C. white, grey, greenish-white; T. 4, to 0; L. vitreous, pearly on the terminal planes of the prism, which are delicately iridescent. It occurs in straight and curved lamellar concretions, and crystallized (fig. 42 *a*, 49).

P. F. a square prism.

Before the blow-pipe it exfoliates, intumesces a little, and fuses with bubbling into a white blebby glass. Forms a jelly in acids.

C. P. Silica 52·90, lime 25·20, potassa 5·26, water 16·00, fluoric acid 00·82, *Berz.*

P. L. Greenland; Iceland; the Faroe Isles; Poonah in Hindostan; Aussig in Bohemia (Werner's Albin); the Tyrol, &c., in trap rocks, with stilbite, natrolite, and other zeolitic minerals. Also, Uton in Sweden, and Oravitzca. &c., in the Bannat, in metalliferous depots.

Note.—The ebullition of this mineral during fusion evidently arises from the fluorine which it contains.

WERNERITE.

Id. Beud.; Scapolite, *Phil.*; Pyramidal Feldspar. *M.*; Paranthine; Arctizite; Dipyre; Meionite.

H. = 5·0—5·5; Sp. gr. 2·5—2·8; C. white, grey, green, reddish, blackish; L. resino-vitreous, resino-pearly. It occurs massive, in granular and fibrous (often radiated) concretions, and crystallized (fig. 36, 37, 38, 52, and 53). P. F. a square prism.

Before the blow-pipe it becomes white and opaque, and fuses easily, with bubbling, into a white blebby glass.

C. P.	(1)	(2)
Silica . . .	45·00	61·50
Alumina . . .	33·00	25·75
Lime . . .	17·00	3·00
Soda . . .	1·50	0·00
Potassa . . .	0·50	0·00
Magnesia . . .	0·00	0·75
Oxide of manganese and iron . . . }	1·00	3·00
Loss . . .	1·40	volatile matter 5·00

(1) From Arendal, by *Laugier*.

(2) From Fåhus Gruftva, by *Berzelius*.

P. L. Arendal and Langsoe in Norway, in gneiss with magnetic iron ore; Pargas in Finland; Malsjo, &c., in Wermeland, Sweden; Greenland, &c., in primitive rocks.

WOLLASTONITE.

Id. Beud.; Tabular Spar, *Phil.*; Prismatic Augite Spar, *M.*

H. = 4·5—5·0; Sp. gr. 2·7—2·9; C. white, grey, yellowish, &c.; translucent; L. vitreo-pearly. It occurs in easily frangible fibrous and lamellar concretions, also disseminated. P. F. as produced by cleavage, a rhomboidal prism of 95° 20', and 84° 40'.

Before the blow-pipe it fuses, with more or less bubbling, into a clear glass.

C. P. Silica 52.58, lime 44.45, magnesia 0.68, oxide of iron 1.13, volatile matter 0.99, *Bonsdorf*.

P. L. Dognaska and Csiklowa in the Bannat, with calc-spar and apophyllite; North America with colophonite; Ceylon with cinnamon-stone; Edinburgh in basalt; Vesuvius; and Pargas in Finland.

Its non-intumescence previous to fusion, and its bubbling during fusion, will easily distinguish it from any of the zeolitic minerals with which it might be confounded by the inexperienced. Tremolite (var. of Hornblende) yields before the blow-pipe a very blebby, nearly opaque glass, otherwise some of its varieties closely resemble the Wollastonite.

DATHOLITE. SILICO-BORATE OF LIME.

Id. Beud., Phil.; Prismatic Dystome Spar, *M.*; Esmarkite, *Haus.*; Humboldtite, *Levy*; Botryolite.

H.=5.0—5.5; Sp. gr. 2.9—3.2; C. white, greenish, yellowish, reddish, grey; L. vitreo-resinous. It occurs massive, reniform, and botryoidal (Botryolite), in fibrous, granular, and lamellar concretions, and crystallized (fig. 156). P. F. a right rhombic prism of $103^{\circ} 42'$ and $76^{\circ} 58'$ (Beud.), or of $103^{\circ} 40'$ and $76^{\circ} 20'$ (Phil.)

Before the blow-pipe it fuses easily, with continued bubbling, into a perfectly clear or transparent glass, which is either colourless, or of a pale-red or green tint. During fusion it generally imparts a faint green tinge to the flame. Gelatinizes in nitric acid.

C. P. Boracic acid 21.67, silica 36.66, lime 34.00, water 5.50, *Vaug.*

P. L. Arendal in Norway, with magnetic iron oxide; Andreasberg in the Hartz; the Seisser Alp, Tyrol, in agate geodes; New Jersey, U.S.; Glen Farg, Perthshire, &c., in primitive and trap rocks, with Prehnite, Stilbite, &c.

SPHENE.

Id. Beud., Phil.; Hemi-prismatic Titanium Ore, *M.*

H.=5.0—5.5; Sp. gr. 3.4—3.6; C. brown, grey, yellow, green, white; L. resino-adamantine. It occurs massive and crystallized (fig. 206 a). P. F. an oblique rhombic prism of $133^{\circ} 30'$ and $46^{\circ} 30'$; inclination of the base on the sides $121^{\circ} 50'$.

Before the blow-pipe all the varieties turn yellowish, and then fuse on the edges and surface, with violent and continued bubbling, into a dark enamel.

C. P. Titanic acid 48, silica 33, lime 19, *Rose*.

P. L. Mont Blanc, St Gothard, Arendal in Norway, Dauphiny, Sweden, Piedmont, Scotland, &c., in primitive rocks. Also, Auvergne, Mont d'Or, in France; Andernach on the Rhine, &c., in trachytic or igneous rocks.

HORNBLLENDE.

Amphibole (Tremolite, Actinote), *Beud.*; Hornblende, &c., *Phil.*; Hemi-prismatic Augite Spar, *M.*

H.=5.0—6.0, otherwise it yields to the nail, or is flexible; Sp. gr. 2.7—3.2, otherwise it is supernatant. P. F. an oblique rhombic prism of about $124^{\circ} 30'$.

Fusible *per se*, with bubbling, into a dark green or colourless glass.

The numerous varieties of this species may be described under four heads.

HORNBLLENDE, or Ambibole.

Including Hedenbergite, Pargasite, and Carinthine.

H. about 6·0; Sp. gr. 3·0—3·2; C. green, inclining to brown or black, always dark; T. 0, or 1. It occurs massive, possessing a slaty fracture (Hornblende Slate); also in columnar concretions and confusedly crystallized (common Hornblende); and in imbedded, perfectly cleavable, black crystals (Basaltic Hornblende) (fig. 219 *a*, 221, 249).

C. P. Silica 45·69, lime 13·83, magnesia 18·79, protoxide of iron 7·32, protoxide of manganese 0·22, alumina 12·18, fluoric acid 1·50, *Bonsdorff*.

P. L. Aussig and Toplitz in Bohemia; Tunaberg in Sweden (*Hedenbergite*); Pargas in Finland with calc-spar (*Pargasite*); the Sau Alpa in Carinthia (*Carinthine*); Arendal in Norway, &c., in primitive and trap rocks; also in the lavas of Vesuvius and other volcanoes.

ACTYNOLITE.

H. about 6·0; Sp. gr. about 3·0; C. green, sometimes dark, but always more or less translucent. It occurs in fibrous and bladed concretions, either parallel or intersecting each other, often curved, and sometimes irregularly radiated; it also occurs in capillary and acicular six or four-sided prisms, and has been divided into crystallized, asbestiform, and glassy actynolite.

Like Hornblende, it fuses with bubbling into a green or yellowish glass or enamel, which often acts on the magnet.

C. P. Silica 53·1, lime 11·4, protoxide of iron 25·6, magnesia 7·8, protoxide of manganese 0·2 (?) alumina 1·7, with traces of potassa and fluoric acid, *Beud.*

P. L. Zillerthal and Greiner in the Tyrol; Piedmont; Norway; Finland; Cornwall; Scotland, &c., in primitive rocks.

TREMOLITE, or Grammatite.

Including Calamite.

H. about 5·5 (5·0—9·9); Sp. gr. 2·8—3·15; C. white, grey, greenish-white, pale green. It occurs in fibrous concretions,* sometimes irregularly radiated, and in flat rhombic prisms of four, six, or eight sides.

Before the blow-pipe it becomes opaque, and fuses, with bubbling, into a white, very blebby glass.

C. P. Silica 59·75, magnesia 25·00, lime 14·11, oxide of iron and alumina 0·50, fluoric acid 0·94, water 0·10, *Bonsdorff*.

P. L. St Gothard in Switzerland, imbedded in domolite, in which it also occurs in Transylvania, and the United States; Corsica, in talc; Gulsjo, Sweden; the Tyrol; Scotland, &c., in primitive rocks. The pale-green variety, termed Calamite, occurs in striated acicular crystals, with calc-spar and magnetic iron ore, in serpentine, at Nordmark in Sweden.

ASBESTUS.

Including some varieties of Amianthus, Rock-wood, Mountain Cork, and Mountain Leather.

The term "Asbestos," as observed by Professor Möhs, rather expresses the state of aggregation of several, than the substance of a distinct mineral.

Some of these varieties belong no doubt to Augite as well as to Hornblende, but as they are not allied by any specific characters to one substance more than to the other, they may be arranged with either, at the option of the reader.

H.=2·5, and under; Sp. gr. 1·0—3·0.

Fusible, with bubbling, into a greyish enamel, or black slag.

* (Asbestiform T.)

Asbestos. White or pale greenish, in masses composed of fibrous concretions; scarcely flexible.

It occurs at Cape Lizard in Cornwall; in Anglesea; Dauphiné; Sweden, &c., in primitive rocks.

Amianthus. White, greenish, &c.; in delicately-fibrous masses, silky, flexible, and somewhat unctuous to the touch.

It occurs in Cornwall, Scotland, Dauphiné, Corsica, the Tyrol, &c., in primitive rocks.

Rock-wood. Brownish; in fibrous and lamellar masses resembling wood; opaque.

It occurs in Scotland, Dauphiné, the Tyrol, &c., with asbestos and other substances, in primitive rocks.

Rock-cork. Brownish; in masses of no observable texture, resembling cork; opaque; floats on water.

It occurs in Scotland, Norway, &c., in primitive rocks.

Mountain Leather. Brownish, or grey, &c.; in flat interlaced fibrous masses, resembling leather; flexible. When very thin and of a yellowish-white colour, this substance is often called Mountain Paper.

It occurs in Argyleshire and Lanarkshire, Scotland, with Rock-Cork, &c.

Appendix to Hornblende.

ARFWEDSONITE.

Id. Phillips, Brooke.

H.=6.0; Sp. gr. 3.4—3.5; C. black; opaque. P. F. a rhombic prism of $123^{\circ} 55'$. Before the blow-pipe it acts like the dark-coloured hornblendes.

It occurs massive, with sodalite and eudyalite, at Kangerdluarsuk in Greenland.

AUGITE.

Pyroxene (Diopside, Hedenbergite, Pyrodmalite), *Beud.*; Augite, &c., *Phil.*; Paratamou Augite Spar, *M.*

H.=5.0—6.0; Sp. gr. 3.1—3.5. P. F. an oblique rhombic prism of $87^{\circ} 5'$ and $92^{\circ} 55'$.

Fusible *per se*, with more or less bubbling, into a dark-green, light-green, or colourless glass.

The numerous varieties of Augite may be described under the following heads:—

AUGITE, or **Pyroxene**, of a dark-brownish or blackish-green colour, opaque or faintly translucent on the edges, occurring commonly crystallized (fig. 216, 217, 219).

C. P. Silica 53.36, lime 22.19, magnesia 4.99, protoxide of iron 17.38, *Rose*.

P. L. Arendal in Norway, Greenland, &c., in primitive rocks; Aussig and Toplitz in Bohemia, Hungary, &c., in trap rocks; and the volcanic tracts of Auvergne, Teneriffe, Etna, Vesuvius, &c.

SAHLITE (Malacolite, Baikallite), of a greenish-grey or green colour, and translucent, commonly crystallized (fig. 207, 208, 209); but it must be mentioned that crystals of this form also occur black and opaque.

C. P. Silica 54.64, lime 24.94, oxide of iron, 1.08, magnesia 18.00, oxide of manganese with magnesia 2.00, *Rose*.

P. L. The silver mines of Sahla and Orijevri in Sweden; Arendal, Norway; the granitic shores of Lake Baikal in Siberia (Baikallite); Tiree, Scotland, in limestone, &c.

DIOPSIDE (including Mussite, Alalite, Pyrgome, Fassaita), generally of a pale or dingy-green colour, though occasionally of a fine pistachio-green tint. Translucent, and occurring in prismatic concretions, and crystallized (fig. 223, 224, 226, and 227, the two last referring to the varieties from Fassa, named Fassaita or Pyrgome).

C. P. Silica 57·5, lime 16·5, magnesia 18·5, oxides of iron and manganese 6·0, *Laugier*.

P. L. Ala and Mussa in Piedmont, Rothenkopf, Zillerthal, Tyrol, of a fine green colour; also the valley of Fassa in the same country.

COCCOLITE (Granular Augite), of a pale or deep-green colour, translucent or nearly opaque, with a vitreous lustre, and occurring in granular concretions or small semi-crystalline masses.

C. P. Silica 50, lime 24, magnesia 10, oxide of iron 7, oxide of manganese 3, alumina 1·5, *Vaug.*

P. L. Arendal in Norway, with quartz in the beds of magnetic iron; Pargas in Finland, &c.

Appendix to Augite.

JEFFERSONITE.

Id. Phil.

H. about 4·5; Sp. gr. 3·51—3·55; C. dark-green or brown; L. resinous, and on the cleavage planes semi-metallic. It occurs in lamellar or crystalline masses.

Fusible into a black globule.

C. P. Silica 56·0, lime 15·1, alumina 2·0, protoxide of manganese 13·5, peroxide of iron 10·0, oxide of zinc 1·0, *Keating*.

P. L. Sparta, New Jersey, with Franklinite, &c.

Note.—The large quantity of manganese contained in this mineral, which, with the zinc also contained in it, is no doubt derived from an admixture of Franklinite, will serve to distinguish it from Augite, when fused with soda before the blow-pipe, particularly in the O. F.

Its degree of hardness also, if the above be correct, is considerably lower than that of the dark-coloured Augites.

BABINGTONITE.

Id. Phil., Levy; Axotomous Augite Spar, *M.*

H. = 5·5—6·0; Sp. gr. 3·4—3·5; C. dark greenish-black. It occurs in small crystals (fig. 264), with albite, garnet, epidote, &c., at Arendal in Norway.

BUCKLANDITE.

Id. Phil., Levy; Dystomic Augite Spar, *Haid.*

H. above 5·5; Sp. gr. 3·94; C. dark blackish-brown; opaque. P. F. an oblique rhombic prism of 109° 20' and 70° 40'. It occurs in small crystals (fig. 232 a) at Arendal, with hornblende, apatite, &c., and also in minute brilliant crystals in lava at the lake of Laach on the Rhine.

Appendix to the Group.

XANTHITE.

Id. Phil.

H. about 1·5; Sp. gr. 3·20; C. greyish or yellow; T. 2, 4. It occurs massive, in small, easily frangible granular concretions.

Fusible, with intumescence, into a greenish glass, which is slightly attractable by the magnet (?).

C. P. Silica 32·71, alumina 12·28, lime 36·31, peroxide of iron 12·00, protoxide of manganese 3·68, water 0·60, *Thomson*.

P. L. Amity in Orange County, U. S., where it occurs with calc-spar.

NUTTALITE.

Id. Brooke, Phil., Beud.

H. = 4·0—5·0; Sp. gr. 2·7—2·8; C. yellowish-white, bluish, green, grey. It occurs in rectangular four-sided prisms.

Fusible, with intumescence (?), into a blebby glass.

C. P. Silica 37·81, alumina 25·10, lime 18·33, protoxide of iron 7·89, water 1·50, Thomson.

L. Bolton in Massachusetts, in limestone with epidote, &c.

HUMBOLDTILITE.

Id. Phil.

H. = 5·0; Sp. gr. 3·10; C. greyish-yellow, grey. It occurs in small crystals, having for their P. F. a square prism.

Easily fusible, with slight intumescence, into a blebby glass.

Calcined and reduced to powder it forms a jelly in acids.

Its locality is Vesuvius, and it was first described and named by Monticelli and Covelli.

OKENITE.

Id. Phil.

H. = 5·0—6·0; Sp. gr. 2·28; C. white, bluish, or yellowish-white. It occurs in delicately fibrous concretions.

Easily fusible, with intumescence, into a blebby glass or enamel.

C. P. Silica 56·99, lime 26·35, water 16·65, alumina, iron oxide, and traces of potassa 0·53, Kobell.

P. L. Disco Island and Tupaursak in North Greenland, in trap rocks.

PHILLIPSITE.

Id. Phil.; Staurytopous Kouphone Spar, *M.*

H. = 4·5; Sp. gr. 2·0—2·2; C. white or reddish; T. 2 or 0. It occurs in maced crystals closely resembling those of Harmotome.

C. P. Silica 48·02, alumina 22·61, lime 6·56, potassa 7·50, water 16·75, *Gmelin*.

P. L. Magee Island in the County of Antrim, and at the Giant's Causeway in Ireland; Lauenstein in Silesia; Capo di Bove near Rome, &c., in trap rocks or ancient lava.

Note.—I have been unable to procure any specimens of this substance, and its comportment before the blow-pipe is not described in any work of which I am aware; but, from its composition, I have presumed that it is fusible with intumescence. The harmotome, which differs from it in containing a considerable quantity of baryta, fuses quietly into a clear glass.

For the convenience of the student, all the mineral substances of the above Group (3) which yield to the nail are here arranged.

Karpholite.	Mesotype, the decomposed	}
Chlorite.	varieties.	
Mica }	Asbestos, &c.	}
Lepidolite. }	Var. of Hornblende.	
Rubellane.	Xanthite.	
Laumonite, the decomposed }		
varieties.		

Group IV.

KEFFEKIL. SILICATE OF MAGNESIA.

Meerschauum, *W.*; Magnesite, *Beud.*; Earthy Carbonate of Magnesia, *Phil.*

H. = 2·0 or less; Sp. gr. 2·6—3·4 (*Beud.*), but it is often as low as 1·25, and some varieties are even supernatant; C. white, yellowish; opaque, dull; adheres to the tongue, but is not unctuous to the touch. It occurs in nodules, veins, and amorphous masses.

Very difficultly fusible into a white enamel.

C. P. Silica 50, magnesia 25, water 25, *Berthier*.

P. L. Baldissero in Piedmont, with magnesite; the Island of Negropont; Brussa, at the foot of Mount Olympus; Vallecas near Madrid; St Ouen, Montmartre, near Paris, &c.

PINITE.

Id. Beud., Phil.; Micarelle, Kirw.

H.=2.0—2.5; Sp. gr. 2.78—2.85; C. greenish or yellowish-grey, also brown; opaque; dull. It occurs in imbedded crystals (fig. 98, 105, 106, 108).

Whitens before the blow-pipe, and fuses on the edges into a very blebby glass.

C. P. Silica 55.96, alumina 25.48, potassa 7.89, oxide of iron 5.51, magnesia with oxide of manganese 3.76, water 1.41, with traces of lime and soda, *Gmelin*.

P. L. Auvergne in France, in decomposed feldspar-porphry; the Tyrol; Cornwall, &c.

Appendix.

GIESECKITE (from Greenland).

H. about 4.5, though often less, from decomposition; Sp. gr. 2.78—2.85; C. brownish or dark-green, greyish when decomposed; translucent in splinters. It occurs in six-sided prisms, and is said to be difficultly fusible on the edges, becoming at the same time magnetic.

C. P. Silica 46.07, alumina 33.82, potassa 6.20, magnesia 1.20, oxide of iron 3.35, oxide of manganese 1.15, water 4.88, *Strom*.

Note.—The substance termed Pinite de Saxe, from Schneeberg, is probably a pseudomorphous variety of Kyanite which has undergone decomposition. Its analysis yielded to Klaproth, silica 29.50, alumina 63.75, oxide of iron 6.75—from which it is arranged by Beudant as an appendix to the last-named mineral.

MARGARITE.

Id. Beud., Phil.; Rhombohedral Pearl Mica, M.

H.=3.0—4.5; Sp. gr. 3.0—3.1; C. white, pearl-grey, reddish; L. vitreous and pearly. It occurs in thin crystalline laminae grouped together. P. F. a six-sided prism.

Before the blow-pipe it becomes white and opaque, and fuses on the edges into a white enamel or very blebby glass, without any bubbling.

L. Sterzing in the Tyrol, with intermixed chlorite, in primitive rocks.

HARMOTOME.

Id. Beud., Phil.; Paratomous Kouphone Spar, M.; Andreolite; Ercinite; Cross-stone.

H.=4.5; Sp. gr. 2.35—2.4; C. white; L. vitreous; translucent. It occurs crystallized simply (fig. 198); and in macles (fig. 247). P. F. a right rectangular prism.

Fusible easily and quietly into a clear glass.

C. P. Silica 49, alumina 16, baryta 18, water 15, *Klapr*.

P. L. Strontian in Argyleshire (simple crystals); Andreasberg in the Hartz (macle crystals), in metalliferous repositories. Also, Oberstein, Schieffenberg, &c., in trap rocks.

MESOTYPE (INCLUDING NATROLITE).

Mesotype, *Beud. Phil.; Prismatic Kouphone Spar, M.; Natrolite.*

H.=5.0—5.5, otherwise friable; Sp. gr. 2.0—2.3; C. white, grey, yellowish, reddish, yellowish-brown. It occurs in curved lamellar, and in stellular and scopiform fibrous concretions, mamillar,

lated, and in (often acicular) crystals (fig. 199 *a*). It also occurs in a friable or semi-decomposed state. P. F. a slightly rhombic prism of $91^{\circ} 20'$ and $88^{\circ} 40'$.

Fusible quietly into a slightly blebby glass; the yellowish-brown mamillated varieties (natrolite) first taking a reddish-brown colour.

All the varieties form a jelly in acids.

C. P.	(1)	(2)
Silica	49.0	47.21
Alumina	27.0	25.60
Soda	17.0	16.12
Water	9.6	8.88
Oxide of iron . . . . .	. . . . .	1.35

(1) Mesotype, Faroe; by Smithson.

(2) Natrolite, Hohentwiel; by Fuchs and Gehlen.

P. L. The Faroe Isles; the Giant's Causeway; Hauenstein in Bohemia; Hauentwiel in Swabia (N.); Val di Fassa (N.); Vesuvius, &c., in trap rocks, or lava.

ANALCIME.

Id. Beud., Phil.; Hexahedral Kouphone Spar, *M.*; Sarcolite; Octahedral Kouphone Spar, *Haid.*; Cubicite.

H. = 5.0—5.5; Sp. gr. 2.0—2.3 (2.53, Beud.); C. white, grey, reddish. It occurs massive, and crystallized (fig. 20, 21, 24, 25 Sarcolite, and 35). P. F. the cube.

Before the blow-pipe it fuses quietly into a glass, free from blebs, the opaque varieties first becoming transparent.

C. P. Silica 55.12, alumina 22.99, soda 13.53, water 8.27, *Rose*.

P. L. Val di Fassa, Tyrol; the Cyclopean Islands near Catania; the Faroe Isles; Dumbartonshire, &c., in trap rocks; Vesuvius in the old debris (Sarcolite); and Arendal in Norway, Andreasberg, &c., in metalliferous depositories; but at these latter localities it is rare.

Appendix to the Group.

Having been unable to procure any specimens of the following substances, I have placed them as an appendix to the above group, premising, however, that some of them may be fusible with ebullition or intumescence, and thereby belonging to Group 3.

EDINGTONITE.

Id. Allan, Phil.; Hemi-pyramidal Feldspar, *Haid.*

H. = 4.0—4.5; Sp. gr. 2.7—2.75; C. greyish-white. It occurs in very small hemi-pyramidal crystals.

Fusible in a strong heat into a colourless mass.

C. P. Silica 35.09, alumina 27.69, lime 12.68, water 13.32, alkali (?) 10.0 or 11.00, *Thomson*.

P. L. Dumbartonshire with Thomsonite.

COUZERANITE.

Id. Beud.; Phil.

H. under 5.0 (?); Sp. gr. 2.69; C. greyish-black, indigo-blue. It occurs in small crystals, derived from an oblique rhombic prism of 84° and 96° , inclination of the base to the sides 92° and 93° .

Fusible into a white enamel.

C. P. Silica 52.37, alumina 24.02, lime 11.85, magnesia 1.40, potassa 5.52, soda 3.96, *Dufresnoy*.

P. L. The Pyrenees (valleys of Vicdessos, Saleix, &c.).

GLAUCOLITE.

*Id. Beud., Phil.*H.=5·0; Sp. gr. 2·7—2·9; C. blue, greenish; L. vitreous. It occurs massive; cleavage form, a rhombic prism of 143° 30' nearly, *Brooke*.Fusible into a blebby white glass (*Beud.*); fusible only on the edges (*Phil.*).C. P. Silica 54·58, alumina 29·77, lime 11·08, potassa 4·57, *Bergmann*.

P. L. Siberia (near Lake Baikal), in limestone and compact feldspar; Norway, with Elaolite.

EUDYALITE.

*Id. Beud., Phil.*H.=5·0—5·5; Sp. gr. 2·89; C. red, or brownish-red; L. vitreous. It occurs massive, and in (generally) small irregular crystals, rhombohedrons of 73° 40', *Beud.*Fusible into a vitreous globule (*Beud.*), or leek-green scoria (*Haid.*, &c.) Forms a jelly in acids.C. P. Silica 53·325, zirconia 11·102, lime 9·785, soda 13·822, oxide of iron 6·754, oxide of manganese 2·062, hydrochloric acid 1·034, water 1·801, *Strom*.

P. L. Greenland, with sodalite, hornblende, &c.

WAGNERITE.

Id. Beud., Phil.

H.=5·0—5·5; Sp. gr. 3·11—3·15; C. yellow, grey, white; L. vitreous. P. F. an oblique rhombic prism of 95° 25' and 84° 35'; inclination of the base, on the lateral planes, 109° 20'.

Difficultly fusible (into a dark greenish-grey glass).

C. P. Phosphoric acid 43·33, magnesia 37·63, fluorine 11·35, magnesium 7·69—

Or phosphate of magnesia 80·96

Fluoride of magnesium 19·04

Beud. from the analysis of Fuchs.

P. L. The Valley of Holgraben, near Werfen, in Saltzberg, in quartz veins - traversing clay-slate. It was named by Fuchs in compliment to M. Wagner, of Munich.

SECTION 6.

B.

Remarks.—The minerals of this Sub-section (B) of Section 6, are too few in number, and too easily distinguishable, to occasion a necessity for their farther division into groups. Those substances, however, which possess the same colour in the Streak or Powder, are, for convenience, placed together.

Sk. Red.

KERMESITE. SULPHURET OF OXIDE OF ANTIMONY.

Kermes, *Beud.*; Red Antimony, *Phil.*; Prismatic Purple Blende, *M.*Sk. brownish-red; H.=1·0—1·5; Sp. gr. 4·5—4·6; C. purplish or brownish-red, often bluish or iridescent externally. L. adamantine, sometimes semi-metallic. It occurs in small groups of capillary crystals, which, when closely interlaced, form the var. termed "*Tinder Ore*;" also in friable coatings. It soils more or less in some varieties. P. F. an oblique rhombic prism.

Fusible easily, and volatilizable.

C. P. antimony 74·45, oxygen 4·27, sulphur 20·47, *Rose*.

P. L. Clausthal and Andreasberg in the Hartz, Allemont, Freyberg, Hungary, &c., with sulphuret of antimony, in primitive rocks.

MINIUM. OXIDE OF LEAD.

Id. Beud., Phil.

Powder and C. aurora-red; friable; Sp. gr. 4·6 (Beud.) It occurs in crusts and small masses.

Easily reducible before the blow-pipe.

C. P. Oxygen 10·38, lead 89·62, *Beud.*

P. L. Grassington Moor, and Grasshill Chapel in Yorkshire; Badenweiler, Baden, &c., commonly with galena.

CINNABAR. SULPHURET OF MERCURY.

Id. Beud., Phil.; Peritomous Ruby-Blende, *M.*; Native Vermilion, Coral-inerz.

Sk. red, in the impure carbonaceous varieties, brownish; H.=2·0—2·5; Sp. gr. 6·7—8·2; C. red, brownish-red, sometimes with a bluish tinge, and then possessing a semi-metallic L. It occurs massive, globular, in curved lamellar concretions, and crystallized (fig. 70, 72, and 93). P. F. a rhomboid of 71° 48' and 108° 12'. It also occurs in a pulverulent state.

Fusible, and entirely volatilizable, with a sulphureous odour. Yielding with soda globules of mercury.

C. P. Sulphur 14·25, mercury 85·00, *Klapr.*

P. L. Almaden in Spain, and Idria in Carniola, Austria, in rocks of the coal formation. Also Transylvania, Carinthia, Mexico, Japan, &c., in primitive rocks.

ARGYRYTHROSE. SULPHURET OF ANTIMONY AND SILVER.

Id. Beud.; Dark Red Silver, *Phil.*; Rhombohedral Ruby-Blende (in part), *M.*

Sk. brownish or purplish-red, never bright; H.=2·0—2·5; Sp. gr. 5·8—5·9; C. dark-red, often with a bluish tinge, and then possessing a semi-metallic lustre; T. 0, or 1. It occurs massive, and crystallized (fig. 89, 90, 93, 109, 110, 110 *a*, 123). P. F. a rhombohedron of 108° 30' and 71° 30'.

Before the blow-pipe it decrepitates, gives off antimonial vapours, fuses, and is reduced.

C. P. Sulphur 16·61, antimony 22·84, silver 58·94, *Bonsdorff.*

P. L. Andreasberg; Freyberg, Königsberg in Norway, Schemnitz in Hungary; Mexico, &c., in primitive rocks, with galena, arsenic, and other minerals.

Note.—Proustite (see Sec. 5) and Argyrythrose were formerly, and are still generally, classed together under the name of Red or Ruby Silver, but in separating them into two distinct species, I have followed the example of M. Beudant, retaining the names bestowed upon them by that excellent chemist and mineralogist.

MIARGYRITE.

Id. Beud., Phil.; Hemi-prismatic Ruby-Blende, *M.*

H.=2·0—2·5; Sp. gr. 5·2—5·4; C. iron-black; Sk. dark purplish-red; opaque, except in thin splinters, when it is translucent, and presents a blood-red colour; L. between adamantine and metallic. It occurs in small crystals with striated surfaces, derived from an oblique rhombic prism of 93° 56' and 86° 4'.

Before the blow-pipe it decrepitates, fuses with extreme ease (giving off abundant antimonial vapours), and is reduced into a small bead of silver.

C. P. Sulphur 21·95, antimony 39·14, silver 36·40, copper 1·06, iron 0·62, *Rose.*

P. L. Braunsdorff near Freyberg in Saxony, with argyrythrose, argentiferous arsenic pyrites, &c.

RUBERITE. RED OXIDE OF COPPER.

Zigueline, Beud. ; Red Oxide of Copper, *Phil.* ; Octahedral Copper Ore, *M.* ; Ruby Copper ; Tile Ore or Ziegelerz.

Sk. brownish-red ; $H.=3.5-4.0$; C. red of various shades, sometimes with a bluish tinge, and then possessing a semi-metallic L. ; T. 2, 3. It occurs massive (with a lamellar structure), and crystallized (fig. 8, 9, 10, 11, 12, 13, 15, 28, 29, 30, 31, 32, 33, and 34 ; also rarely 20, 21, and 22). P. F. the regular octahedron.

In nitric acid it dissolves with effervescence, colouring the solution green or blue.

Before the blow-pipe, on charcoal, it is reduced into a globule of copper, the reactions of which metal it gives with the fluxes.

C. P. Oxygen 11.5, copper 88.5, *Chenevix*.

P. L. Cornwall ; Chessy in France, with Carbonate of Copper ; Moldawa in the Bannat ; Siberia, &c., in primitive rocks.

Note.—A variety in acicular crystals, either reticulated or otherwise aggregated, and to which the name of Capillary Red Oxide of Copper has been given, occurs in Cornwall and at Rheinbreitback. The ferruginous variety named Tile Ore, is a mixture of oxide of copper and oxide of iron. It blackens before the blow-pipe, but is infusible.

See Sec. 7, B (Appendix), of this Division.

Sk. Yellow.

MOLYBDIC ACID.

Id. Beud. ; Oxide of Molybdena, *Phil.* ; Molybdic Ochre.

Pulverulent ; in dull, friable, yellow, or greenish crusts.

Fusible with white fumes ; if on charcoal, it sinks into it, and is reduced. With microcosmic salt, it gives immediately a green glass.

C. P. Oxygen 33.39, molybdenum 66.61, but it is usually mixed with a little oxide of iron.

P. L. Saxony, Sweden, &c., in very small quantities with Molybdenite.

OXIDE OF BISMUTH.

Id. Phil., Beud. ; Bismuth Ochre ; Flowers of Bismuth.

Powder and C. yellow ; friable ; Sp. gr. about 4.36.

Fusible on the platina foil, and very easily reducible on charcoal.

Soluble in nitric acid ; an abundant white precipitate, formed in the solution by water.

C. P. Oxygen 10.13, bismuth 89.87, *Beud.*

P. L. Schneeberg in Saxony ; Joachimsthal in Bohemia ; Cornwall, &c., encrusting various ores of Bismuth, Cobalt, and Nickel.

PHOSPHATE OF URANIA.

Pyramidal Euchlore Mica, *M.*

This substance is divided into two subspecies : Uranite and Chalkolite.

(1) URANITE.

Id. Beud., Phil.

Sk. light yellow ; $H.=2.0-2.5$; Sp. gr. 3.0—3.2 ; C. lemon-yellow, when decomposed, brownish ; L. pearly, pearly-adamantine.

It occurs in scales or small lamellar masses (which are not flexible), and also crystallized (fig. 38 a, 63 a). P. F. a right square prism.

Fusible into a bluish-black globule, with a slightly porous structure and semi-metallic lustre.

- C. P. Phosphoric acid 14·63, oxide of uranium 59·37, lime 5·66, water 14·90, with minute portions of silica, baryta, magnesia, oxide of manganese and fluorine, *Berz.*
 P. L. Near Autun and Limoges in France, &c., in primitive rocks (granite, pegmatite), or in the argillaceous matters arising from their decomposition.

(2) CHALKOLITE.

Id. Beud., Phil.; Green Uranite.

Sk. green; H.=2·0—2·5; Sp. gr. 3·33; C. green.

Its other characters agree with those of the Uranite, except that it gives indications of copper with the fluxes before the blow-pipe.

- C. P. Phosphoric acid 16, oxide of uranium 60, oxide of copper 9, water 15, *R. Phil.*
 P. L. Cornwall, in tin and copper veins; Bohemia, Saxony, &c., in cobalt and silver veins; Bavaria, in primitive rocks, with beryl and tantalite.

PITTIZITE.

Id. Beud.; Partly the "Pitchy Iron Ore" of Mineralogists.

Sk. pale lemon-yellow; H.=2·0—2·5; Sp. gr. about 2·15; C. brown or reddish-brown; translucent; L. vitreous or resino-vitreous. It occurs massive, botryoidal, &c., without any indications of cleavage.

Before the blow-pipe it immediately becomes opaque and intumesces exceedingly, throwing out numerous ramifications like borax; subsequently it fuses into a brittle steel-grey globule, which becomes magnetic on the blast being continued. During fusion it does not emit the slightest odour of arsenic.

With borax and microcosmic salt it gives the reactions of iron, and those of sulphur, with soda, or glass of soda and silica.

C. P. Sulphuric acid 15·9, peroxide of iron 62·4, water 21·7, *Berz.*

P. L. Freyberg in Saxony, &c.

Note.—This substance has been generally confounded in mineralogical works with the Sideratine (see Sec. 5), under the names of Pitchy Iron Ore, Eisensinter, &c.; but although formed like that mineral from depositions by waters holding sulphate of iron in solution, it nevertheless differs from it, in not containing the slightest portion of arsenic acid. It is closely related to the Botryogene or Neoplas (see Sec. 1); but from this mineral, its insolubility in water, and total want of cleavage or crystalline form, will render it distinct, though I believe that the Pittizite (at least in some varieties) contains, like the Botryogene, both the peroxides and protoxides of iron.

CROCOISITE. CHROMATE OF LEAD.

Crocoise, *Beud.*; Chromate of Lead, *Phil.*; Hemi-prismatic Lead Baryte, *M.*; Kallochrom, *Hans.*

Sk. orange-yellow; H.=2·5; Sp. gr. 5·9—6·1 (6·60, *Beud.*, but this is probably a misprint for 6·06); C. hyacinth-red; T. 2, 1; L. adamantine. It occurs in flakes and crusts, but more commonly crystallized (fig. 222, 225). P. F. an oblique rhombic prism of 93° 30' and 86° 30'; inclination of the base to the sides, 99° 10'.

Before the blow-pipe it decrepitates, fuses, and, on charcoal, is reduced to metallic lead.

C. P. Chromic acid 31·5, oxide of lead 68·5, *Berz.*

P. L. Beresof in Siberia, in gneiss, with quartz, gold, iron-pyrites, &c.; Brazil, in decomposed granite.

Sk. blue.

VIVIANITE. PHOSPHATE OF IRON.

Sk. nearly white, but on exposure it soon becomes blue; H.=2.0, if not friable; Sp. gr. 2.6—2.7.

Fusible, with intumescence, into a magnetic globule.

See A of this Section.

CUPREOUS SULPHATE OF LEAD.

Id. Phil., Beud.; Diplogenic Lead Baryte, *Haid.*

Sk. pale-blue; H.=2.5—3.0; Sp. gr. 5.3—5.4; C. azure-blue; translucent. P. F. a right oblique-angled prism of $102^{\circ} 45'$ and $77^{\circ} 15'$.

Fusible and reducible into a globule of lead and copper, which, with borax, gives indications of the latter metal.

C. P. Sulphate of lead 74.4, oxide of copper 18.0, water 4.7, *Brooke.*

L. Leadhills in Scotland, with Anglesite, &c.

Sk. green.

HISINGERITE.

Id. Beud., Phil.

Sk. greyish-green; H. about 2.0; Sp. gr. 3.04; C. black. It occurs in lamellar masses.

Fusible into a dull, black, and magnetic globule.

C. P. Silica 27.50, alumina 5.50, protoxide of iron 47.80, oxide of manganese 0.77, water 11.75, *Hisinger.*

L. Sudermanland, Sweden, with calc-spar.

ATAKAMITE. CHLORIDE OF COPPER.

Id. Beud.; Muriate of Copper, *Phil.*; Prismatoidal Habroneme Malachite, *M.*

Sk. pale-green; H.=3.0—3.5; Sp. gr. 4.0—4.4; C. green. It occurs massive, in small grains and fibrous concretions, and also in minute crystals (fig. 180). P. F. a right rhombic prism of about 100° and 80° , according to Phillips; or if taken in another sense (according to Möhs and Beudant), of $112^{\circ} 45'$ and $67^{\circ} 15'$.

Before the blow-pipe it fuses and is reduced, colouring the flame blue and green, and when exposed with salt of phosphorous and oxide of copper, previously fused together, the reactions of chlorine take place, imparting a deep-blue colour to the flame.

C. P. Chlorine 15.90, copper 14.20, oxide of copper 54.22, water 14.16, oxide of iron 1.60. From the analysis by Klaproth.

P. L. Remolinos, Guasco, &c., in Chili; Tarapaca in Peru; the Desert of Atakama, between the two countries, &c., in primitive rocks with copper, silver, and iron ores. Also Vesuvius, in fissures of the lava. The variety in scaly particles is artificially produced in Peru, by pounding the massive and crystallized varieties in order to use them as blotting sand.

VAUQUELINITE. CHROMATE OF LEAD AND COPPER.

Id. Beud., Phil.; Hemi-prismatic Olive Malachite, *Haid.*

Sk. brownish-green; H.=2.5—3.0; Sp. gr. 5.8—6.0 (6.8—7.2, Levy and Beud.); C. black, blackish-green, dark-brownish. It occurs mamillated, in crusts, and in groups of minute crystals.

P. F. an oblique rhombic prism (?).

Fusible, with slight intumescence and considerable bubbling, into a dark metallic-looking globule, surrounded by small globules of reduced lead. With borax it gives indications of copper.

C. P. Chromic acid 28·33, oxide of lead 60·87, oxide of copper 10·80, *Berz.*

P. L. Berezof in Siberia, with crocoisite; Pont Gibaud, Puy de Dome, with the same; Brazil.

BROCHANTITE.

Id. Beud., Phil.

Sk. and C. green; $H.=3\cdot5-4\cdot0$; Sp. gr. $3\cdot75-3\cdot9$; transparent or nearly so. It occurs in small crystals and probably also massive. P. F. a right rhomboidal prism of 117° and 33° .

Reducible on charcoal, and giving with the fluxes the reactions of copper.

C. P. Sulphuric acid 17·426, oxide of copper 66·935, water 11·917, oxide of lead 1·048, oxide of tin 3·145, *Magnus.*

L. Ekatherinenberg in Siberia, with malachite and native copper.

Note.—The Koenigite or Konigine, from the same country, is generally classed with the above. C. green or blackish-green; T. 4; $H.=2\cdot0-3\cdot0$.

P. F. a right rhomboidal prism of 105° and 75° . Its locality is Werchoturi, where it is said to be disseminated in feruginous oxide of copper.

PYRODMALITE.

Id. Beud.; Pyrosmalite, Phil.; Muriate of Iron.

Sk. pale-greenish or brownish; $H.=4\cdot0-4\cdot5$; Sp. gr. $2\cdot9-3\cdot1$; C. liver-brown or green. It occurs massive, and in six-sided prisms, which cleave easily parallel to their bases.

Before the blow-pipe it emits a weak acid odour, and fuses readily into a brilliant iron-grey globule, which is attractable by the magnet. With borax it gives indications of iron, and develops, when fused with soda on the platina foil or wire, the reactions of manganese.

C. P. Silica 35·85, protoxide of iron 21·81, protoxide of manganese 21·14, chloride of iron 14·095, lime 1·21, water, &c. and loss 5·895, *Hisinger.*

L. Nordmark in Wermeland, Sweden, at the iron mine of Bjelke-gruvan, with augite, calc-spar, magnetic iron ore, &c., in primitive rocks. Elba is also mentioned by Breithaupt as a locality.

APHERESE, OR LIBETHENITE.

Apherase ($\alpha\phi\alpha\rho\epsilon\sigma\iota\varsigma$, subtraction), *Beud.*; Phosphate of Copper, *Phil.*; Di-prismatic Olive Malachite, *M.*

Sk. green; $H.=4\cdot0$; Sp. gr. $3\cdot6-3\cdot8$; C. deep-green, blackish-green. It occurs in radiated fibrous concretions, in small compact masses, and crystallized (fig. 186, 187), the crystals being often minute. P. F. a right rhombic prism of about 110° and 70° ; or if taken in another sense (according to Beudant), an octahedron with rectangular base, the common form of the crystals.

Fusible, with great ebullition, into a shining black or reddish globule containing a bead of copper, the reactions of which metal it gives with the fluxes.

C. P. Phosphoric acid 28·7, oxide of copper 63·9, water 7·4, *Berthier.*

P. L. Libethen in Hungary, in quartz with copper pyrites, ruberite, &c. Also Gunnis Lake mine in Cornwall.

YPOLEIME, OR RHENITE.

Ypoleime ($\upsilon\pi\omicron\lambda\epsilon\iota\mu\mu\alpha$, the remainder of the sum or whole part), *Beud.*; Hydrrous Phosphate of Copper, *Phil.*; Prismatic Habroneme Malachite, *M.*

Sk. green; $H.=5\cdot0$; Sp. gr. $4\cdot2-4\cdot3$; C. bright-green, generally spotted or striated with black. It occurs commonly massive,

also mamillated, in fibrous concretions, and crystallized (fig. 201, 202, and 203). P. F. an oblique rhombic prism of about 141° and 39° . The crystals are generally very minute.

Before the blow-pipe it melts into a shining-black or reddish globule containing a bead of copper, and which emits, on congealing, a bright gleam of light. This curious phenomenon does not take place in the Apherese or Libethenite. With the fluxes it gives the reactions of copper.

C. P. Phosphoric acid 21.687, oxide of copper 62.847, water 15.454, *Rev. F. Lunn*, confirmed by *M. Arfwedson*.

L. Rheinbreitbach, near Bonn, on the Rhine, with quartz, &c., in graywacke.

KERARGYRITE. CHLORIDE OF SILVER.

Sk. same as the C., but shining, and resinous; H.=1.0—2.0; Sp. gr. 5.5—6.0.

Fusible, and reducible into a globule of silver.

See A of this Section (Group 1).

Sk. black.

MELACONISE. BLACK OXIDE OF COPPER.

Melaconise, *Beud.*; Black Copper, *Phil.*; Copper Black.

Powder, black, resinous in the Sk.; friable, or H. under 2.5; soils more or less, and takes, when rubbed, a semi-metallic lustre.

It occurs massive, but more generally investing other substances, chiefly the copper pyrites and cuprazurite, from the decomposition of which it appears to be formed.

Fusible, with bubbling, into a dark-grey globule, which yields in the R. F. a bead of copper. With the fluxes, it gives the reactions of that metal. Soluble in nitric acid, tinging it green or bluish.

C. P. Oxygen 20.17, copper 79.83, *Beud.*

P. L. Cornwall; Chessy, near Lyons; Freyberg; Silesia; Hungary; Siberia, &c.

Sk. brown.

PYRORTHITE.

Id. Berz., Beud., Phil.

Sk. brownish-black; H.=2.5; Sp. gr. 2.19. Burns before the blow-pipe, and melts into a black enamel, which gives with the fluxes the reactions of cerium, &c.

See Sec. 3 of this Division.

SORDAWALITE.

Id. Beud., Phil.

Sk. liver-brown; H.=2.5—3.0; Sp. gr. 2.53—2.58; C. bluish-greenish-, or greyish-black; opaque. It occurs in thin uncleavable masses.

Fusible into a black metallic-looking globule, which gives with soda traces of manganese.

C. P. Silica 49.40, alumina 13.80, peroxide of iron 18.17, magnesia 10.67, phosphoric acid 2.68, water 4.38, *Nordenskiöld*.

P. L. Sordawala in Finland, in argilo-feruginous rocks; Bodenmais in Bavaria.

PYROCHLORE.

Id. Beud., Phil.; Octahedral Titanium Ore, *M.*

Sk. pale-brown; $H.=5.0$; Sp. gr. $4.2-4.25$; C. dark reddish-brown, blackish in the fracture; T. 0, 1. It occurs crystallized in octahedrons, which are uncleavable.

Before the blow-pipe it first becomes greenish-yellow, and then fuses, but with difficulty, into a blackish scoria. With borax it gives the reactions of Titanium and cerium, becoming opaque by flaming.

C. P. Titanic acid 82.75, lime 12.85, protoxide of manganese 2.75, oxide of iron 2.16, oxide of uranium 5.18, oxide of cerium 6.80, oxide of tin 0.61, water 4.20, *Wohler*.

L. Frederickswärn and Laurwig in Norway, in the zircon-syenite.

TRIPLITE. PHOSPHATE OF MANGANESE AND IRON.

Triplite, *Beud.*; Phosphate of Manganese, *Phil.*; Phosphormangan.

Sk. brown or grey; $H.=5.0$; Sp. gr. $3.4-3.8$; C. blackish-brown. It occurs massive. P. F. as obtained by cleavage, a rectangular prism.

Fusible, with bubbling, into a metallic-looking and magnetic globule, which imparts to soda on the platina wire the reaction of manganese.

See A of this Section (Group 1).

HORNBLLENDE.

Id. Phil.; Amphibole, *Beud.*; Hemi-prismatic Augite Spar, *M.*

Sk. in some varieties, pale-brown, though generally greyish-white; $H.=5.0-6.0$; Sp. gr. $2.7-3.2$.

Fusible, with more or less bubbling, into a dark-green glass.

See A of this Section (Group 3).

Appendix to the Sub-Section.

CHLOROPAL.

Id. Beud., Phil.

$H.=3.0-4.0$, otherwise friable; Sp. gr. $1.7-2.0$; C. dark-green, yellowish-green, lighter in the Sk. It occurs massive, possessing a more or less conchoidal fracture, and also in an earthy state.

Fusible into a black glass.

C. P. Silica 46.0, oxide of iron 35.3, water 18.0, with small portions of magnesia, alumina, and oxide of manganese, *Brandes*.

L. Unghwar in Hungary, with opal, in earthy matters arising from the decomposition of trachytic rocks.

SIDEROSCHISOLITE.

Id. Beud., Phil.

$H.=2.0-3.0$; Sp. gr. 3.0 ; C. black; Sk. green. It occurs in small shining six-sided prisms. P. F. a rhomboid, with single cleavage perpendicular to the axis.

Fusible into a black magnetic glass. Soluble in acids.

C. P. Silica 16.3, protoxide of iron 70.16 (black oxide of iron 75.5), alumina 4.1, water 7.3, *Wernekinck*; altered by *Beud.*

L. Conghonas do Campo in the Brazils, with magnetic iron pyrites.

KROKIDOLITE.

Id. Phil., &c.

$H.=4.0-4.5$; Sp. gr. $3.2-3.4$; C. and Sk. blue or greenish; it is also said to occur of a yellow colour. Massive, and in fibrous masses, which are elastic and silky, like asbestos.

Fusible into a black magnetic globule.

C. P. Silica 51·64, protoxide of iron 34·38, protoxide of manganese 0·02, magnesia 2·64, lime 0·05, soda 7·11, water 4·01, *Strom.*

L. The Orange River, near the Cape of Good Hope, in Africa.

It has been regarded as a variety of asbestos, and is arranged as such in the collection at the British Museum.

SECTION 7.

A.

Remarks.—The minerals of this Sub-Section are arranged in the three following Groups :—

Group 1. Comprising those substances which, when fused with borax, yield a glass that may be rendered opaque by flaming, or which turns opaque on cooling.

Note.—With the exceptions of the Scheelite and Fluocerine, all the mineral substances of this Group will produce the above reaction, also with Microcosmic Salt.

Group 2. Comprising those substances which do not yield an opaque glass with borax (nor one capable of becoming so by flaming), and which are scarcely acted upon by Microcosmic Salt, forming with that reagent a more or less transparent (and often opaline) glass, containing in its centre an insoluble “skeleton” of silica.

Group 3. Comprising those substances which likewise do not yield an opaque glass with borax, but which fuse entirely with Microcosmic Salt into a transparent glass, either coloured or colourless.

Group I.

BRUCITE. HYDROUS MAGNESIA.

Brucite, *Beud.*; Hydrate of Magnesia, *Phil.*; Native Magnesia.

H.=1·0—1·5; Sp. gr. 2·3—2·4; C. white, greenish; L. pearly; adheres slightly to the tongue. It occurs in foliated masses.

P. F. a rhombohedron (?).

Before the blow-pipe it is infusible, but becomes friable, and turns turmeric-paper brown.

C. P. Magnesia 70, water 30, *Bruce.*

P. L. Hoboken, New Jersey, in serpentine, and in the same rock in Unst, one of the Shetland Isles.

YTTROCERITE.

Id. Beud., Phil.; Fluoride of Yttrium and Cerium, *Berz.*

H.=between 4·5 and 7·0; Sp. gr. 3·4—4·15; C. violet, reddish-brown, greyish-red; opaque. It occurs in crusts, and amorphous masses. P. F. an oblique rhombic prism (?).

Infusible; giving with the fluxes the reactions of cerium.

C. P. Fluorine 44·52, cerium 13·04, yttrium 6·48, calcium 35·96, from Finbo, *Berz.*

P. L. Finbo and Brodbo in Sweden.

STIBICONISE. EARTHY OXIDE OF ANTIMONY.

Id. Beud. ; Antimonial Ochre, *Phil.*

Friable ; Sp. gr. 3·7—3·8 ; C. greyish or yellowish-white. It occurs in crusts (on other ores of antimony).

Infusible ; partly volatilizable in the R. F. ; reducible with soda.

C. P. Oxide of antimony and water.

P. L. The same as those of the Stibine (Sulphuret of Antimony), which see.

ZINC-BLENDE. SULPHURET OF ZINC.

Blende, *Beud.* ; Sulphuret of Zinc, *Phil.* ; Dodecahedral Garnet Blende, *M.*

H.=3·5—4·0 ; Sp. gr. 4·0—4·2 ; C. brown, blackish-brown, red, black, more rarely yellow or green ; Sk. white in the light-coloured varieties, in the others, brown ; L. adamantine. It occurs massive, in granular and fibrous concretions, and crystallized (fig. 1, 2, 3, 5, 7, 8, 9, 12, 15, 20 (rare), 23, 28, 29, and 30). P. F. the rhombic dodecahedron.

Infusible, decrepitates ; giving with glass of soda and silica the reactions of sulphur.

C. P. Sulphur 33·0, zinc 61·5, iron 4·0, from England, *Berthier*.

P. L. Derbyshire, Cumberland, Cornwall ; the Hartz, Hungary, Transylvania, Saxony, Bohemia, Sweden, &c. &c., principally with galena and other ores of lead, in secondary, transition, and primary rocks.

Note.—Some varieties of zinc-blende contain cadmium, as the fibrous and botryoidal varieties from Przibram in Bohemia, and Fowey in Cornwall.

SCHEELITE. TUNGSTATE OF LIME.

Scheelite, *Beud.* ; Tungstate of Lime, *Phil.* ; Pyramidal Scheelium Baryte, *M.*

H.=4·0—4·5 ; Sp. gr. 6·0—6·1 ; C. greyish or yellowish-white ; L. resino-vitreous ; adamantine. It occurs massive and crystallized (fig. 55, 56, 57, 61, 62, and 63). P. F. an acute four-sided pyramid, which, when double, is closely allied to the regular octahedron.

Infusible, except on the edges ; decrepitating. Giving with microcosmic salt the green and blue colours indicative of Tungstic Acid.*

C. P. Tungstic acid 80·417, lime 19·400, *Berz.*

P. L. Zinwald and Schlaggenwald in Bohemia ; Sweden, France, Cumberland, Cornwall, &c., chiefly in primitive rocks, with oxide of tin, wolfram, sulphuret of molybdenum, and other minerals.

FLUCERINE.

Id. Beud. ; Neutral Fluato of Cerium, *Phil.*

H. about 4·0 ; Sp. gr. 4·7 ; C. reddish, or yellow ; dull, opaque, except when in thin splinters. It occurs massive, and in six-sided prisms (?).

Infusible, blackening in the R. F. ; imparting to the fluxes the reactions of cerium.

C. P. Fluorine 33·58, cerium 65·53, yttrium 0·89, *Beud.*, from the analysis by *Berzelius*.

P. L. Brodbo and Finbo in Sweden, in primitive rocks.

Note.—The Basicerine of Beudant (Fluate of Cerium with excess of base, of *Berz.*) is of a yellow colour, with a compact or semi-crystalline structure,

* This refers to the perfectly pure varieties, for when the Scheelite contains oxide of iron (which is sometimes the case), the glass becomes of a deep brownish-red colour.

sometimes resembling certain varieties of porcelain jasper (Allan's Manual, p. 62), though considerably less hard than that substance. It is likewise infusible before the blow-pipe, blackening, and becoming first red, and subsequently orange-yellow, on cooling. It occurs at Bastuaes and Finbo (?) in Sweden, but is very scarce.

BREUNNERITE.

Id. Phil.; Giobertite (in part), *Beud.*; Brachytypous Lime-Haloide, *M.*

H.=4.0—4.5; Sp. gr. 3.0—3.2; C. grey, yellow, white, brown.

It occurs in imbedded rhombic crystals, and crystalline groups.

P. F. a rhomb of $107^{\circ} 22'$.

Infusible. Soluble in nitric acid without (or with very feeble) effervescence.

C. P. Carbonic acid 49.93, magnesia 43.44, protoxide of iron 4.98, oxide of manganese 1.52, *Stromeyer*.

P. L. Zillertal, Halle, &c., in the Tyrol, in chlorite slate; Island of Unst, in talc, &c.

MAGNESITE.

Carbonate of Magnesia, *Phil.*; Giobertite (in part), *Beud.*

H.=about 3.5—4.5, though often very soft externally; Sp. gr.

2.6—2.9. Effervesces very feebly in cold acids.

See Section 2 of this Division.

MAGNESO-CALCITE.

Macrotypous Lime Haloide, *M.*; Dolomie, *Beud.*; Bitter Spar, *Phil.*

H.=3.5—4.0; Sp. gr. 2.8—2.95. Effervesces feebly in cold (but more perceptibly in warm) acids. P. F. a rhomb of $106^{\circ} 15'$ and $73^{\circ} 45'$.

See Section 2 of this Division.

APATITE. PHOSPHATE OF LIME.

Id. Beud., Phil.; Rhombohedral Fluor Haloide, *M.*

H.=5.0; Sp. gr. 3.1—3.3; C. white, yellow, green, blue, and red.

It occurs massive and crystallized (fig. 93, 96, 97, 98, 99, 100, 102, 106, 112, and 114). P. F. the regular six-sided prism.

Infusible; with microcosmic salt it fuses on charcoal into a globule, which, on cooling, presents crystalline facets, but this experiment requires that the flux should be saturated up to a certain point, and no further. Slowly soluble in nitric acid.

C. P. Phosphate of lime* 92.16, fluoride of calcium 7.69, chloride of calcium 0.15, *Rose*.

P. L. Saxony, Bohemia, in tin veins; Arendal in Norway, &c., in the magnetic iron repositories; Dramen in Norway, with ores of lead; also Cornwall, Devonshire, Cumberland, the Tyrol, St Gothard, France, Russia, &c., in primitive rocks; and Laach on the Rhine, Herault, Bouches-du-Rhone in France; Jumilla, &c. in Spain; Albano, Vesuvius, in Italy, in trap rocks and lava.

Note.—A mineral greatly resembling the above, from the tin mines of Ehrenfriedersdorf in Saxony, has been distinguished by Haidinger, under the name of Herderite. H.=5.0; Sp. gr. 2.9—3.1. P. F. a right rhombic prism of $115^{\circ} 9'$ and $64^{\circ} 51'$. (See *Phil. Min.* 4th ed. p. 172.)

YTTRIO-COLUMBITE.

Yttrio-Tantalite, *Beud., Phil.*, &c.; Tricolumbate of Yttria.

H.=4.5—5.5; Sp. gr. 5.0—5.9; C. yellow (Yellow Yttrio-Tantalite, Sp. gr. 5.8—5.9), dark brownish (Dark Yttrio-Tantalite,

* Consisting of five atoms of phosphoric acid, and one of lime; or phosphoric acid 45.52, lime 54.48=100 parts.

Sp. gr. about 5.0), and black (Black Yttrio-Tantalite, Sp. gr. 5.3—5.5); Sk. white or grey. L. resino-vitreous, semi-metallic in the black varieties. It occurs massive.

Infusible, decrepitates.

C. P.	(1)	(2)	(3)
Columbic Acid . . .	59.50 . . .	52.82 . . .	57.00 . . .
Yttria . . .	24.90 . . .	38.52 . . .	20.25 . . .
Lime . . .	3.29 . . .	3.26 . . .	6.25 . . .
Peroxide of Iron . . .	2.72 . . .	0.56 . . .	3.50 . . .
Oxide of Uranium . . .	8.23 . . .	1.11 . . .	0.50 . . .
Tungstic Acid . . .	1.25 . . .	2.59 . . .	8.23 . . .

(1) Yellow; (2) dark, the tungstic acid containing oxide of tin; and (3) black Yttrio-Columbite, *Berz.*

L. Sweden, in primitive rocks (Ytterby, Brodbo, and Finbo).

MENGITE.

Monazite, *Phil.* (Breithaupt); Mengite, *Brooke.*

H.=5.0; Sp. gr. 4.9—4.95; C. red; L. vitreous. P. F. a doubly-oblique prism.

Infusible, except on the thinnest edges.

This mineral is supposed to be a combination of oxide of uranium with lime, or some other metallic oxide, yielding with borax the same characteristic effects. It has been brought from the vicinity of Ilmensee in Siberia.

ÆSCHYNITE.

Id. Phil.

H.=5.0—6.0; Sp. gr. 5.1—5.5; C. dark-black, by transmitted light (when in thin fragments), brownish-yellow. P. F. an oblique rhombic prism of about 127° and 53° (Brooke).

Before the blow-pipe it intumesces, but is infusible (?). With borax it yields a dark-yellow glass, which, when saturated, becomes opaque on cooling, or when flamed.

C. P. Titanic acid 56.0, zirconia 20.0, oxide of cerium 15.0, lime 3.8, oxide of iron 2.6, oxide of tin 0.5, *Hartwall.*

L. The Ilmen range near Miask, in the Ural, Siberia, imbedded in granite with zircon.

See also B of this Section.

ELECTRO-CALAMINE. SILICATE OF ZINC.

Siliceous Oxide of Zinc, *Phil.*; Calamine, *Beud.*; Prismatic Zinc Baryte, *M.*; Electric Calamine; Willemite.

H.=5.0; Sp. gr. 3.3—3.6; C. white, yellow, grey, green, brown; L. 0, 1; becomes electric when gently heated. It occurs massive, botryoidal, cellular, &c.; in fibrous and lamellar concretions, and also crystallized (fig. 173, 174, 175, and 176). P. F. a rhombic prism of 102° 30' and 77° 30'.

Infusible. With borax it melts easily, and in large quantity, into a colourless glass, which becomes milky when flamed, but the glass requires to be well saturated before it can be made so.

C. P. Silica 24.893, oxide of zinc 66.837, water 7.460, with minute portions of carbonic acid and the oxides of lead and tin. From Limburg, *Berz.*

P. L. The Mendip Hills; Derbyshire; Wanlockhead; Altenberg near Aix-la-Chapelle; Carinthia; Hungary, &c., chiefly in secondary rocks, with zinc-blende, zinc-spar, and ores of lead.

Appendix to the Group.

MICROLITE (from Massachusetts).

H.=5.0—5.5; Sp. gr. 4.75—5.0; C. yellow, brown. P. F. the regular octahedron.

*Group II.**

LITHOMARGE.

Id. Phil.

H. about 2·5, or friable; Sp. gr. about 2·43; C. greyish, bluish, reddish, or yellowish-white; shining in the Sk.; feels greasy, and adheres to the tongue. It occurs massive, and in glimmering scaly particles.

C. P. Silica 45·25, alumina 36·50, water 14, oxide of iron 2·75, from Rochlitz in Saxony, *Klapr.*

P. L. The tin mines of Saxony and Bohemia; Cornwall, &c.

STEATITE. SILICATE OF MAGNESIA.

Id. Beud.; Soap-Stone, Phil.; Speckstein, W.

H.=2·0 or less; Sp. gr. 2·6—2·8; C. white, grey, greenish, bluish, &c., often in veins or patches; feels greasy; Fr. splintery. It occurs massive, sometimes forming pseudomorphous crystals. Hardens before the blow-pipe.

C. P. Silica 60·12, magnesia 30·15, protoxide of iron 3·02, oxide of copper 0·58, water 5·63, from Bayreuth, *Bucholz* and *Brandes*.

P. L. Gopfersgrün in Bayreuth; Freyberg, Saxony; Bohemia; Portsoy in Aberdeenshire, Anglesey, Cornwall, &c.

TALC.

Id. Beud.; Chlorite (in part), Phil.; Prismatic Talc-Mica (in part), M.

H.=1·0—1·5; Sp. gr. 2·6—2·8; C. white, greenish-white, apple-green, very unctuous to the touch. It occurs massive (possessing either a large foliated, or compact, structure), and also in small six-sided tables.

Before the blow-pipe it separates in the direction of its laminae, and becomes of an opaque white, but is infusible.

C. P. Silica 58·2, magnesia 33·2, protoxide of iron 4·6, traces of alumina, water 3·5, from St Bernard, *Berthier*.

P. L. The Tyrol, Switzerland; Island of Unst, &c.

CHLORITE.

Id. Beud.; Chlorite (in part), Phil.; Prismatic Talc-Mica (in part), M.

H.=1·5; Sp. gr. 2·6—2·8; C. dark-green; not unctuous to the touch. It occurs in foliated masses and six-sided tables.

Before the blow-pipe all the varieties (at present classed with this substance) whiten and become opaque, some remaining infusible, some fusing on the edges, and others fusing into a black globule.

See Section 6, A (Group 3), of this Division.

C. P. Silica	26·8	26·0	35·0
Alumina	19·6	18·5	18·0
Protoxide of iron	23·5	43·0	29·9
Magnesia	14·3	8·0	9·7
Potassa	2·7	2·0	
Water	11·4	2·0	2·7
	<i>Berthier.</i>	<i>Vauq.</i>	<i>Lampad.</i>

P. L. Cornwall, the Tyrol, Sweden, &c.

* For the pyrognostic characters of the minerals of this, and the following Group, the reader is also referred to the remarks at the head of the Subsection.

Appendix.

Green Earth, occurring in masses of a bluish or greyish-green colour, which yield to the nail, and are dull and opaque. It is found in amygdaloidal rocks in Saxony, Bohemia, &c.; but it must be observed that the name of *Green Earth*, is often improperly given to the small altered or decomposed crystals of Augite and Hornblende, which occur in similar situations.

Note.—The mineral substances arranged under this title, are, like those to which the generic name of Mica is given, but very imperfectly known. They are generally arranged with the preceding species, Talc, although the greater part, if not the whole of them, differ greatly in composition from that substance, which is a non-aluminous silicate of magnesia, and, as such, close^{*}

PYROPHYLLITE.

Id. Phil.

H.=1·5; Sp. gr. 2·8; C. greenish. It occurs in fibrous radiated concretions, of a pearly lustre.

Before the blow-pipe it exfoliates very much, but is infusible.

C. P. Silica 59·79, alumina 29·46, magnesia 4·0, oxide of iron 1·8, water 5·62, *Hermann*.

L. The Ural Mountains, Siberia.

Note.—This substance is usually considered to be a variety of Talc, but if the above analysis be correct, it may be more justly referred to Chlorite or Mica.

MICA.

Id. Beud., Phil.; the Rhombohedral and Hemi-prismatic Talc-Mica (in part) of Möhs.

H.=1·5—2·5, but the edges of the laminæ scratch glass; Sp. gr. 2·7—3·0; Structure, broad foliated, the foliæ elastic.

Infusible in some varieties, in others fusible.

See Section 6, A (Group 3), of this Division.

KOLLYRITE.

Id. Phil.; Collyrite, *Beud.*

H.=1·5; Sp. gr. 2·06—2·11; C. white; very sectile; shining in the Sk. It occurs in small masses, either translucent, and having somewhat the aspect of gum, or opaque, and then resembling clay.

Infusible. Gives off water and falls into a powder, when calcined. Absorbs water, and forms in acids a gelatinous mass.

C. P. Silica 14, alumina 45, water 42, *Klapr.*

P. L. Schemnitz in Hungary, and Esquera on the river Oo, in the Pyrenees, in primitive rocks.

HALLOYSITE.

H.=1·5; Sp. gr. 1·8—2·1; C. white, or pale bluish-grey; Fr. conchoidal, and of a resinous or waxy aspect; adheres to the tongue. It occurs in nodules which absorb water, and form a jelly in acids.

C. P. Silica 39·3, alumina 34·0, water 16·00, *Berthier*.

P. L. Liège and Namur, with ores of zinc, lead, &c., in secondary rocks.

Appendix.

SCARBROITE (from near Scarborough, in Yorkshire).

* In the arrangement of Minerals in Chapter III, these substances are classed together.

H. about 1·5 or 2·0; Sp. gr. 1·48; C. white; dull; adheres to the tongue. Occurs massive; Fr. conchoidal.

C. P. Silica 7·9, alumina 42·75, water 48·55, peroxide of iron 0·80, *Vernon*.

PIMELITE. HYDROUS SILICATE OF NICKEL.

Id. Beud., Phil.

H.=2·0 and less; C. greenish, yellowish; dull; opaque; earthy-looking, and unctuous to the touch. It occurs massive, and investing Chrysoprase, &c.

Giving off water and blackening by calcination. Presenting with the fluxes the reactions of nickel.

C. P. Silica 35·00, oxide of nickel 15·62, water 37·91, alumina 5·10, magnesia 2·25, lime 0·40, *Klapr.*

L. Silesia, (at Kosēmutz, &c.), in serpentine.

AGALMATOLITE (FIGURE-STONE).

Id. Phil.; Pagodite, Beud.; Bildstein, W.

H.=1·5—2·0; Sp. gr. 2·65—2·85; C. greenish, reddish, yellowish, bluish-grey, brown, often in veins or patches; unctuous to the touch. It occurs massive.

Infusible; partly soluble in sulphuric acid, leaving a residue of silica.

C. P. Silica 56·0, alumina 29·0, potassa 7, water 5·0, lime 2, oxide of iron 1·0, *Vaug.*

P. L. China, from whence it is brought in small images; Nagyag in Transylvania; Caernarvonshire.

PINITE.

Id. Beud., Phil.; Micarelle, Kirwan.

H.=2·0—2·5; Sp. gr. 2·78—2·85 (2·98, *Beud.*); C. greenish or yellowish-grey, brown; opaque; dull. It occurs in imbedded crystals (fig. 98, 105, 106, 108).

Before the blow-pipe it whitens, and fuses on the edges into a very blebby glass.

See Section 6, A (Group 4), of this Division.

CHRYSOCOLLA. SILICATE OF COPPER.

Id. Beud., Phil.; Uncleavable Staphyline Malachite, M.

H.=2·0—3·0 when pure; Sp. gr. 2·0—2·2; C. green, greenish-blue, brownish; uncleavable. It occurs massive, botryoidal, stalactitic, and investing other ores of copper. Partly soluble in nitric acid (sometimes with slight effervescence), a residue of silica remaining.

Blackens before the blow-pipe, and gives, with the fluxes, the reactions of copper.

C. P. Silica 26, oxide of copper 50, water 17, carbonic acid 7, *Klapr.*

P. L. Cornwall; Siberia; Hungary, &c., in copper veins in primitive and secondary rocks.

SERPENTINE.

Id. Beud., Phil.; Ophite.

H.=3·0; Sp. gr. 2·5—2·6; C. dark-green, yellow, grey, brown; translucent (*noble serpentine*), or opaque; Fr. splintery, conchoidal.

Infusible. Gives off water, and hardens before the blow-pipe.

C. P. Silica 43·07, magnesia 40·37, water 12·45, with minute portions of oxide of iron, lime, and alumina, *Hisinger*.

P. L. The Tyrol, Norway, Sweden, Corsica, New York, Cornwall, Aberdeenshire, &c., forming veins, nodules, and beds, in primitive rocks.

Appendix.

MARMOLITE (from North America).

H. about 3·0; Sp. gr. 2·41—2·47; C. green or grey; L. pearly. It occurs in foliated or columnar masses, which yield to cleavage parallel to the planes of a four-sided prism.

Forms in nitric acid a gelatinous mass.

Separates into fibres and hardens before the blow-pipe.

C. P. Silica 36, magnesia 46, water 15, with minute portions of lime, and the oxides of iron and chromium, *Nuttal*.

It occurs in serpentine rocks with Brucite (Hydrous Magnesia), in New Jersey, and near Baltimore, U. S.

PICROLITE* (from Sweden).

H.=3·5—4·0; C. green, yellowish; shining in the Sk. It occurs massive, and in radiated fibrous concretions, in veins with serpentine and calc-spar, at the Taberg in Smaland ('Allan's Manual').

C. P. Silica 40, magnesia 38·80, protoxide of iron 8·28, water 9·08, carbonic acid 4·70, *Almroth*.

It is regarded by Beudant as a mixture of Talc, Brucite, and Carbonate of Magnesia.

Note.—Another substance termed "Picrolite de la mine de Brattfor en Vermeland," of a green colour, and seemingly-striated, splintery fracture, is regarded also by Beudant as an impure variety of Serpentine. It yielded to Stromeyer: Silica 41·66, magnesia 37·16, magnetic oxide of iron 4·046, oxide of manganese 2·25, water 14·72.

PICROSMINE* (from Presnitz in Bohemia).

H.=2·5—3·0; Sp. gr. 2·58—2·66; C. green, greenish-white; sectile. It occurs in fibrous concretions, resembling asbestos, but when breathed upon it emits a bitter argillaceous odour.

C. P. Silica 54·88, magnesia 33·34, protoxide of iron 1·39, protoxide of manganese 0·42, water 7·30, *Magnus*.

ALLOPHANE.

Id. Beud. Phil.; Riemannite.

H.=3·0; Sp. gr. 1·8—1·9; C. pale-blue, greenish, brownish; L. vitreous; very brittle. It occurs massive, in granular concretions.

Infusible before the blow-pipe, but it becomes friable, and tinges the flame slightly green. With the fluxes in the R. F. it gives indications of copper, particularly if a little tin be added to the globule. In acids it forms a jelly.

C. P. Silica 21·92, alumina 32·20, water 41·30, blue carbonate of copper 3·05, lime 0·73, gypsum 0·51, hydroxide of iron 0·27, *Strom*.

P. L. Groefenthal, near Saalfeld in Thuringia; Gersbach in the Black Forest; Schneeberg in Saxony, in Syenite with hydrous oxide of iron; the Palatinat.

* Since the above was in type, I have received from Berlin specimens of these substances, and have, therefore, to offer to the reader's notice the following additions to their descriptions:—

Picrolite: Sp. gr. about 2·55; L. waxy; structure, also straight or diverging fibrous. Infusible before the blow-pipe, unless it be in a very thin fibre, in which case it melts on the edges into a white enamel. Other Lo. Reichenstein in Silesia.

Picrosmine: Powder, soft and unctuous to the touch; L. pearly. Behaves like the above before the blow-pipe, but hardens considerably. Other Lo. Zöblitz in Saxony.

PYRALLOLITE.

Id. Beud., Phil.

H.=3·0—3·5, but often, from decomposition, friable; Sp. gr. 2·55—2·6; C. greenish-white, yellowish; opaque, except in thin scales. It occurs in foliated masses and in long flat rhombic prisms. P. F. an oblique rhombic prism of $140^{\circ} 49'$ (?).

Whitens before the blow-pipe, and fuses on the edges. The powder phosphorescent on a red-hot iron.

C. P. Silica 56·62, magnesia 23·38, lime 5·58, alumina 3·38, water 3·58, peroxide of iron 0·99, *Nordenskiöld*.

P. L. Storgard, parish of Pargas in Finland, with Calc-spar, Wernerite, Felspar, and Augite.

Note.—In the last edition of 'Phillips' Mineralogy,' this substance is arranged as a sub-species of Hornblende. By Beudant it is considered to be a variety of Talc.

PSEUDO-ANDALUSITE.

H.=4·25—5·0; Sp. gr. 3·22—3·55; C. grey. In slightly rhombic prisms of considerable size. Infusible.

See Andalusite (*note*), Division III, Section 2, B.

BRONZITE.

Id. Phil.; Diallage (in part), *Beud.*; Hemi-prismatic Schiller-spar, *M.*

H.=4·0—4·5; Sp. gr. 3·0—3·3; C. pinchbeck-brown, ash-grey.

L. metallic-pearly. It occurs in laminar and granular concretions. P. F. an oblique four-sided prism.

Infusible, or very difficultly fusible on the edges.

C. P. Silica 56·81, magnesia 29·67, lime 2·19, protoxide of iron 8·46, *Kohler*.

P. L. Kraubat, Upper Stiria, in serpentine; Hoff in Bayreuth; Uten-Thal, Tyrol; Cornwall; Island of Skye, in greenstone; &c.

ANTHOPHYLLITE.

Id. Beud., Phil.; Prismatic Schiller-Spar, *M.*

H.=5·0—5·5; Sp. gr. 3·0—3·3; C. clove-brown, sometimes inclining to grey; L. pearly, metallic-pearly. It occurs in fibrous (often radiated) concretions, also in fibrous-laminar concretions, and in acicular crystals. P. F. a rhombic prism of about 125° and 55° (*Phil.*), or 116° and 74° (*Beud.*).

Infusible.

C. P. Silica 62·66, alumina 13·33, magnesia 4·0, lime 3·33, oxide of iron 12·0 oxide of manganese 3·25, water 1·43, *John*.

P. L. Near Königsberg, and Snarum near Modum, in Norway, with mica, hornblende, &c.; Greenland; Connecticut; Inverness-shire, Scotland, in primitive rocks (chiefly mica-slate).

DYSCLASITE.

Id. Phil. (Connell).

H.=4·0—5·0; Sp. gr. 2·362; C. white; very tough. It occurs massive, and in fibrous concretions, of a vitreous lustre.

Fusible only on the edges, without previously intumescing. Forms, when in powder, a jelly in muriatic acid.

C. P. Silica 57·69, lime 26·83, water 14·71, with minute portions of potassa, soda, oxide of iron, and oxide of manganese, *Connell*.

L. The Faroe Isles.

THOMSONITE.

Id. Beud., Phil.

H.=5·0; Sp. gr. 2·35—2·38; P. F. a right rectangular prism with square base.

Before the blow-pipe it curls up very much into a frothy mass, which melts on the edges, but which is very difficultly reducible into a globule.

See Section 6, A (Group 3), of this Division.

CHIASTOLITE.

Id. Phil.; Var. of Andalusite, *Beud.*; Macle, *H.*; Hohlspath, *W.*

H.=5.0—5.5; Sp. gr. 2.9—3.0; C. white, grey, reddish, parseminated with black. It occurs in maced rectangular or slightly-rhomboidal prismatic crystals, which are generally very thin or acicular; when of sufficient size to be apparent, their cross sections exhibit the appearances represented in fig. 265 and 266.

Infusible.

C. P. Silica 68.49, alumina 30.17, magnesia 4.12, oxide of iron 2.7, water 0.27, *Landgrabe.*

P. L. Cumberland, Wicklow, Gefrees in Bavaria, Barèges in the Pyrenees, Spain, Normandy, &c., imbedded in clay-slate. Very fine specimens have lately been brought from Chili, South America.

KYANITE.

Id. Phil.; Disthene, *Beud.*; Prismatic Disthene Spar, *M.*; Rhaetizite.

H.=5.0—7.0; Sp. gr. 3.5—3.7; C. blue, white, grey, yellowish, reddish (rhaetizite); T. 2, 4; L. pearly, vitreous. It occurs massive, in lamellar and bladed or fibrous-lamellar concretions, and crystallized (fig. 241, 243). P. F. a doubly oblique prism of $106^{\circ} 15'$, and $73^{\circ} 45'$. Inclination of the base on the lateral planes $100^{\circ} 50'$ and $79^{\circ} 10'$ in one direction; and $93^{\circ} 15'$ and $86^{\circ} 45'$ in the other. Infusible.

C. P. Silica 36, alumina 64, *Arfwedson.*

P. L. St Gothard in Switzerland, closely associated with crystals of Staurolite in mica slate; Pfäfersthal, Tyrol; the Sau-alp in Carinthia, with garnet, &c.; Botrifrey, Banffshire, in gneiss; Shetland, &c.

ALUMSTONE.

Id. Phil.; Alunite, *Beud.*; Rhombohedral Alum Haloide, *M.*

H.=5.0; Sp. gr. 2.4—2.75; C. white, grey, reddish, brown. This substance is often mixed with a portion of silica, but when pure it dissolves entirely in microcosmic salt, thereby belonging to the following Group, which see.

Appendix to the Group.

BATRACHITE.

(From Rizoni in the Tyrol).

H.=5.0; Sp. gr. 3.038; C. greenish-white; L. resino-vitreous. It occurs massive, exhibiting traces of a rhombic prism of 115° . Infusible. (*Phil. Min.* p. 398.)

Group III.

TUNGSTIC ACID.

Id. Beud.; Oxide of Tungsten, *Phil.*

Friable, or H. under 1.5; Sp. gr. 6.0; C. yellow, greyish-yellow; powder, greyish. It occurs massive, and in earthy coatings.

Infusible; giving with microcosmic salt the blue colour indicative of tungsten. Insoluble in acids. Soluble in heated ammonia.

C. P. Oxygen 20.23, tungsten 79.77, *Beud.*

P. L. County of Mourse, U. S.; Huttonington, Connecticut(?); Zinwald, Bohemia(?); with wolfram, &c.

WEBSTERITE.

Id. Beud.; Sub-sulphate of Alumina, *Phil.*; Aluminite; Hallite.

H.=2.0, and less; Sp. gr. 1.65—1.7; C. white, greyish, yellowish-white; adheres to the tongue. It occurs in dull reniform masses, and imbedded nodules.

Before the blow-pipe it curls up into a white, ramified, and friable mass, which glows intensely, but does not fuse.

C. P. Sulphuric acid 23.27, alumina 29.86, water 46.76, *Strom.*

P. L. Newhaven in Sussex, Halle in Prussia, Auteuil near Paris, &c., in tertiary strata.

GIBBSITE.

Id. Beud., Phil.; Thonhydrat.

H. about 3.5; Sp. gr. 2.40; C. greyish, or greenish-white. It occurs in the form of small aggregated stalactites composed of radiated fibrous concretions.

Infusible; giving off water, and becoming of an opaque white.

C. P. Alumina 64.8, water 34.7, *Torrey.*

L. Richmond, Massachusetts, in a mine of brown hematite, according to *Phil.*; or of manganese (psilomelane), according to *Beud.*

WAVELLITE.

Id. Beud., Phil.; Sub-phosphate of alumina; Devonite; Lasionite; Hydrargillite.

H.=3.5—4.0; Sp. gr. 2.3—2.35; C. yellowish-white, greyish, greenish, brown. It occurs in fibrous-globular concretions (the fibres radiated), and in minute imperfect crystals, derived from a right rhombic prism of $122^{\circ} 15'$ and $57^{\circ} 45'$.

Before the blow-pipe it becomes white and opaque, tinging the flame slightly green, and separating into fibres, which crumble to the touch, but are infusible. In the matrass it gives off water which turns Brazil-wood paper yellow, and slightly corrodes the glass.

C. P. Phosphoric acid 33.40, alumina 32.14, water 26.80, lime 0.50, oxides of iron and manganese 1.25, fluorine 3.56, aluminium 1.71, *Berz.*, reduced (according to the theory of Fluorine) by *Beud.*

P. L. Barnstaple, Devonshire, in clay-slate; St Austle, Cornwall, on decomposing granite; Dumbarton; Spring Hill, near Cork; Zbirow in Bohemia, on red sandstone; Langenstriegis near Freyberg; Amberg, Bavaria, on brown hæmatite, &c.

SIDEROSE, OR IRON SPAR.

Siderose, *Beud.*; Spathose Iron, *Phil.*; Carbonate of Iron; Brachytypous Parachrose Baryte, *M.*; Sphærosiderite.

H.=3.5—4.5; Sp. gr. 3.6—3.8; C. yellowish-grey, yellow, brown, blackish. It occurs massive, globular (Sphærosiderite), in fibrous masses, and crystallized (fig. 65 to 69, 98, &c.). P. F. an obtuse rhombohedron of 107° and 73° .

Soluble, with very feeble effervescence in cold, but with brisk effervescence in heated, acids.

Infusible, but blackens, and becomes magnetic.

C. P. Carbonic acid 38.72, protoxide of iron 59.97, protoxide of manganese 0.39, lime 0.92, from England, *Beud.*

P. L. Cornwall, Devonshire, Cumberland, Styria, Carinthia, the Hartz, Freyberg, in Saxony, &c., in metalliferous veins, chiefly in primitive rocks; also, Hanau, &c., in trap rocks (Sphærosiderite).

Appendix.

CLAY IRON-STONE.

H.—under 3·0; Sp. gr. 3·0—3·6; C. yellow, brown, ash-grey; L. 0, or 1; opaque.

Infusible, but blackens and becomes magnetic.

C. P. Carbonate of iron 80·0 to 55·30, carbonate of manganese 1·60 to 2·20, carbonate of lime 0·50 to 11·0, carbonate of magnesia 2·0 to 4·0, silica and clay 0·0 to 25·9, water and bitumen 1·30 to 2·10. Analysis of two specimens from Allier, in France, by Berthier.

Varieties: compact; reniform; columnar; lenticular or oolitic; phytoidal (in the form of fossil plants); earthy, &c.

P. L. The coal-fields of Great Britain, France, Bohemia, &c.

CALAITE, OR TURQUOISE.

Calaite, *Phil.*; Turquoise, *Beud.*; Uncleavable Azure Spar, *M.*; Odontolite; Agaphite; Johnite.

H.=5·0—6·0; Sp. gr. 2·8—3·0 (3·6 *Beud.*); C. blue, greenish-blue, bluish-green; dull; T. 0, or 1. It occurs massive, generally mamillated, and does not possess any cleavage; it also occurs in an earthy or decomposed state.

Decrepitates and gives off water in the matrass. Infusible alone; with the fluxes it presents indications of copper.

C. P. Phosphate of alumina, phosphate of lime, silica, oxide of copper, oxide of iron, water, *Berz.*

P. L. Khorassan, Persia, in clay, or slate-clay.

Note.—The true Turquoise may be easily distinguished from the coloured fossil teeth or bones, to which the name of Occidental Turquoise has been given, by the following characters:

TRUE TURQUOISE.

Scratches glass. Yields no odour before the blow-pipe. Not affected by acids.

BONE TURQUOISE.

Does not scratch glass. Yields when heated the peculiar odour characteristic of animal matter. Soluble (in chief part) in acids, particularly in the muriatic.

KLAPROTHINE.

Id. Beud.; Azurite, *Phil.*; Prismatic Azure Spar, *M.*; Lazulit; Voraulite; Blue Feldspar.

H.=5·0—6·0; Sp. gr. 3·0—3·1; C. blue, bright or pale; T. 0, 2; L. 1, 2, vitreous; easily frangible. It occurs in small granular masses, rarely crystallized. P. F. a right rhombic prism of 121° 30' and 58° 30'.

Before the blow-pipe it intumesces on the edges, and takes a vitreous aspect, but does not fuse.

C. P. Phosphoric acid 43·32, alumina 34·50, magnesia 13·56, silica 6·50, with minute portions of lime, oxide of iron, and water, *Brandes.*

P. L. Voral and Krieglach, in Styria, with quartz; Schlamming and Radelgraben, Salzburg, in clay-slate.

ALUMSTONE.

Id. Phil.; Alunite, *Beud.*; Rhombohedral Alum Haloide, *M.*

H.=5·0; Sp. gr. 2·4—2·75; C. white, grey, reddish, brownish; L. 1. It occurs massive, vesicular, and in minute rhombs. P. F. an obtuse rhomboid of 92° 50' and 87° 10'.

Infusible, decrepitates. Gives with glass of soda and silica, the reactions of sulphur.

C. P. Sulphuric acid 35.49, alumina 39.65, potassa 10.02, water 14.83, *Cordier*.
 P. L. Tolfa, in the Roman States, Muzsay and Beregh, in Hungary, Mount
 d'Or in Auvergne, the crater of Volcano, &c.

Appendix to the Group.

KAKOXENE.

(From near Zbirow, in Bohemia.)

H. under 2.5; Sp. gr. 3.38; C. yellow, brownish-yellow. It occurs in radiated fibrous concretions, on brown iron ore.

Infusible (?), decrepitating. Phosphorescent on a red-hot coal.

C. P. Phosphoric acid 17.86, alumina 10.01, silica 8.90, peroxide of iron 36.82, lime 0.15, water and fluoric acid 25.95, *Steinmann*.

CHILDRENITE.

(From Tavistock, in Devonshire.)

H.=4.5—5.0; C. yellow, brownish-yellow; L. vitreous. It occurs in very minute rhomboidal octahedrons (*Beud.*), on siderose, quartz, iron pyrites, &c.

C. P. Phosphoric acid, alumina, iron, *Wollaston*.

SECTION 7.

B.

Remarks.—The minerals of this Sub-section, which possess the same colour in the Sk. or powder, are, for convenience, placed together, there being no necessity for their farther sub-division into Groups.

Sk. Yellow.

URACONISE.

Id. Beud.; Carbonate of Uranium, *Phil.*

Pulverulent, or H. under 1.5; C. yellow; dull; opaque; soils slightly. It occurs in friable coatings and crystalline flakes on other minerals. Infusible, becoming greenish in the R. F., and giving with the fluxes the reactions of uranium.

It is said to be soluble with effervescence in nitric acid, the solution yielding a brown precipitate with prussiate of potash. (*Phil.*)

P. L. Joachimsthal in Bohemia, on pitch-uran, &c.

SARTALITE. RED OXIDE OF ZINC.

Red Oxide of Zinc, *Phil.*, *Beud.*; Spartalite; Prismatic Zinc Ore, *M.*

Sk. orange-yellow; H.=4.0—4.5; Sp. gr. 5.4—5.5; C. bright-red, yellowish-red. It occurs disseminated, and in small masses.

P. F. a right rhombic prism of about 125 and 55°.

Infusible alone; forming with B. and M. S. a clear glass, rendered opaque by flaming, and more or less coloured by manganese. Giving also indications of this latter metal, with soda on the platina foil.

C. P. Oxide of zinc 92, oxides of iron and manganese 8, *Bruce*.

P. L. The Franklin and Stirling iron mines near Sparta in New Jersey, N. A., with the Franklinites, &c.

Sk. green.

CHROMIC ACID.

Id. Beud.; Oxide of Chrome, *Phil.*

Pulverulent,* or H. under 5·5; in green earthy crusts.

Infusible alone; giving with the fluxes the reactions of pure chromic acid. (See Chapter I.)

C. P. Oxygen 29·89, chromium 70·11.

P. L. Ecouchets, Saone-et-Loire, in France; Elfdalen (?) in Dalecarlia; Piedmont (?), &c., in primitive rocks.

PINGUITE.

Id. Phil. (Leonhard, Breithaupt).

Sk. and C. green; H.=1·0—1·5; Sp. gr. 2·315; unctuous to the touch. It occurs massive.

Infusible (?).

C. P. Silica 36·90, oxide of iron 35·60, water 25·10, with small portions of alumina, magnesia, and oxide of manganese, *Kersten.*

L. Wolkenstein, Bohemia; with sulphate of baryta.

CRONSTEDITE.

Id. Beud., Phil.; Rhombohedral Melane Mica, *M.*

H.=2·5; Sp. gr. 3·3—3·35; C. black; Sk. brownish-green; in thin laminæ, slightly elastic. It occurs massive, in fibrous groups, and in small six-sided prisms, aggregated laterally. P. F. a rhombohedron.

Before the blow-pipe it emits a few bubbles, but does not fuse. Forms (when in powder) a gelatinous mass in muriatic acid.

C. P. Silica 22·45, oxide of iron 58·85, oxide of manganese 2·89, magnesia 5·08, water 10·70, *Steinmann.*

P. L. Przibram in Bohemia, with carbonate of iron, iron pyrites, &c.; Wheal Maudlin, Cornwall.

DIOPTASE.

Id. Phil., Beud.; Rhombohedral Emerald-Malachite, *M.*; Achirite; Emerald Copper.

H.=5·0; Sp. gr. 3·2—3·4; C. bright emerald-green, paler in the Sk.; translucent. It occurs only crystallized, in lengthened rhombic dodecahedrons (fig. 109). P. F. an obtuse rhomboid of 126° 17' and 53° 43'.

Infusible, blackens. With the fluxes it gives the reactions of copper, and is reduced.

C. P. Silica 36·60, oxide of copper 48·89, water 12·29, protoxide of iron 2·00, *Hess.*

L. Siberia (the Kirghese Steppes), on quartz. It is a rare mineral.

Sk. black.

CUPREOUS MANGANESE.

Id. Phil.

Sk. and C. bluish-black; H. about 1·5; Sp. gr. 3·15—3·25; L. resinous. It occurs in botryoidal groups.

Infusible; giving with the fluxes the reactions of manganese; and yielding grains of copper with a mixture of borax and soda.

* This refers to the perfectly pure varieties, but as this substance usually occurs more or less mixed with quartz, &c., its hardness is occasionally as high as 5·0.

C. P. Oxide of manganese 74·10, oxide of copper 4·80, water 20·10, gypsum 1·05, silica 0·30, *Kersten*.

L. The tin mines of Schlaggenwald in Bohemia. It is a very rare mineral.

CHRICHTONITE.

Sk. black; H.=4·5; Sp. gr. 4·0; C. violet-black; L. generally metallic.

Infusible.

See Part II, Div. II, Sec. 2, B.

TITANIO-FERRITE.

Including Nigrine, Menaccanite, Iserine, and Ilmenite.

C. black; Sk. black or brown; H.=5·0—6·0; Sp. gr. 3·26—4·89;

L. inclining to semi-metallic; more or less attractable by the magnet.

Infusible alone.

See Div. III, Sec. 1, B (Gr. 1).

ÆSCHYNITE.

Sk. dark grey or black; H.=5·0—6·0; Sp. gr. 5·1—5·5; P. F. an oblique rhombic prism. Intumesces slightly and becomes yellowish, but is infusible.

See A (Gr. 1) of this Section.

Sk. brown.

ZINC-BLENDE. SULPHURET OF ZINC.

Sk. brown in the dark-coloured varieties, in the others, paler-brown, and white; H.=3·5—4·0; P. F. the rhombic dodecahedron.

See A (Gr. 1) of this Section.

PHOSPHYTTRITE.

Phosphyttria, *Berz.*; Xenotime, *Beud.*; Phosphate of Yttria, *Phil.*

Sk. pale-brown; H.=4·5—5·0; Sp. gr. 4·5577 (*Beud.*), 4·14—4·55 (*Phil.*); C. yellowish-brown; L. resinous. It occurs in small lamellar masses and imperfect, aggregated crystals (fig. 60). P. F. a right prism with square base.

Infusible alone. Gives with borax a glass which turns milky on cooling, or when flamed.

C. P. Phosphoric acid (with a little fluoric acid) 33·49, yttria 62·58, sub-phosphate of iron 3·93, *Berz.*

P. L. Lindenaes in Norway, in coarse-grained granite; Ytterby, Sweden.

Note.—This substance was at first considered to be the oxide of a new metal, to which the name of Thorium (since bestowed upon the metal discovered in the Thorite) was given. From this circumstance Beudant's name of Xenotime (*χενος*, vain, *τιμη*, honour) was derived.

MICROLITE.

Sk. brownish, if the colour be brown, otherwise white; H.=5·0—5·5; Sp. gr. 4·75—5·0.

See A (App. to Gr. 1) of this Section.

HYDRO-FERRITE.

Brown Iron Ore.

Sk. yellowish-brown; H.=4·5—5·5 (some varieties are friable); Sp. gr. 3·5—4·2; L. semi-metallic in some varieties, metallic in others.

Infusible *per se*, but becoming magnetic after exposure to the blow-pipe, and of a red or black colour.

See Part II, Div. II, Sec. 2, B.

ANHYDRO-FERRITE.

Red Iron Ore.

Sk. cherry-red, brownish-red; H. often very low in those varieties which do not possess a strong metallic aspect, otherwise it is from 5·5—6·5; L. feebly metallic, or perfectly metallic.

Infusible, but becomes magnetic after roasting.

See Part II, Div. II, Sec. 2, B.

Appendix to the Sub-section.

TILE-ORE.

(A mixture of Red Oxide of Copper and Brown Iron Ochre.)

H.=1·0—5·0; Sp. gr. under 5·5; C. red, brownish-red, greyish-brown; L. sometimes semi-metallic in the compact varieties; opaque.

Infusible, blackens. Gives with the fluxes the reactions of copper and iron.

P. L. Cornwall; Thuringia, &c., with ores of copper and iron, in primitive rocks.

CHAMOISITE.

(From Mount Chamoison in the Valais.)

H. about 4·5(?) (scratched by the knife, Beud.); Sp. gr. 3·0—3·4; C. greenish-grey, black; magnetic. It occurs massive and in granular concretions (oolitic, Beud.).

Infusible, blackening and becoming more magnetic. In the matrass it gives off water, and is partly soluble in acids, leaving a gelatinous mass of silica.

C. P. Silica 14·3, alumina 7·8, protoxide of iron 60·5, water 17·4, *Berthier*.

CHLOROPHÆITE.

(From Scotland, &c.)

H.=1·0; Sp. gr. 2·020; C. dull green in the fresh fracture, becoming black on exposure to the air; brittle(?).

Unalterable before the blow-pipe.

C. P. Silica, oxide of iron, alumina. It occurs in small nodules imbedded in trap rocks, and was first described by Dr MacCulloch.

STILPNOSIDERITE.

(From Saxony, &c.)

H.=4·5; Sp. gr. 3·6—3·65; C. brownish-black; Sk. yellowish-brown; L. splendid, semi-metallic.

Infusible.

C. P. Silica 2·25, oxide of iron 80·50, water 16·00, *Ullmann*.

It occurs massive and in botryoidal groups, with Brown Hæmatite, from which mineral it cannot (rigorously speaking) be separated. See Hydro-Ferrite.

PELONONITE.

(From Remolinos in Chili.)

H.=3·5(?); Sp. gr. 2·5—2·57; C. blackish-blue; Sk. brown.

According to Kersten, it is a mixture of hydrous oxide of manganese, hydrous oxide of iron, oxide of copper, and silica. (See 'Allan's Manual,' p. 316; 'Phil. Min.' p. 247.)

DIVISION III.

SECTION 1.

A.

Remarks.—The minerals of the present Sub-section are arranged in the three following groups :—

Group 1. Comprising those substances which, when held (in thin splinters) in the flame of a candle, give off water, and become white and opaque.

Group 2. Comprising those substances which do not become opaque in the flame of a candle, but which form a gelatinous mass, or are more or less soluble, in acids.

* * These substances require to be reduced to powder, and in several instances the application of heat is also necessary, but if the reader please, he may pass over this character (which it may not be at all times convenient to try), and unite the minerals of this with those of the following group.

Group 3. Comprising the remaining substances, or those which do not present either of the above effects.

Group I.

MESOTYPE.

H.=5.0—5.5; Sp. gr. 2.0—2.3; P. F. a slightly rhombic prism of $91^{\circ} 20'$ and $88^{\circ} 40'$.

Fusible without intumescence.

See Div. II, Sec. 6, A (Gr. 4).

ANALCIME.

H.=5.0—5.5; Sp. gr. 2.0—2.3; P. F. the cube. Common crystallizations (fig. 20 to 25).

Fusible without intumescence.

See Div. II, Sec. 6, A (Gr. 4).

BREWSTERITE.

H.=5.0—5.5; Sp. gr. 2.1—2.4; P. F. an oblique rectangular prism.

Crystals (fig. 205 a).

Fusible, with previous intumescence.

See Div. II, Sec. 6, A (Gr. 3).

SCOLEZITE.

H.=5.0—5.5; Sp. gr. 2.2—2.3; P. F. a slightly rhombic prism, agreeing very nearly with that of the Mesotype, but from this mineral it may be distinguished by its intumescence previous to fusion.

See Div. II, Sec. 6, A (Gr. 3).

COMPTONITE.

H.=5.0—5.5; Sp. gr. 2.3—2.4; P. F. a right rectangular prism.

Fusible, previously intumescing.

See Div. II, Sec. 6, A (Gr. 3).



OKENITE.

H.=5.0—6.0; Sp. gr. 2.28. Occurs in delicately-fibrous concretions.

Fusible, with previous intumescence.

See Div. II, Sec 6, A (App. to Gr. 3).

DATHOLITE.

H.=5.0—5.5; Sp. gr. 2.9—3.2; P. F. a right rhombic prism of $113^{\circ} 42'$ and $76^{\circ} 58'$.

Fusible without previous intumescence, but with continued bubbling.

See Div. II, Sec. 6, A (Gr. 3).

PREHNITE.

Id. Beud., Phil.; Axotomous Triphane Spar, *M.*; Koupholite.

H.=6.0—7.0; Sp. gr. 2.8—3.0; C. green, greenish-white, yellowish, greyish; Sk. white; L. pearly; electric by heat. It occurs massive, reniform, in fibrous concretions, and crystallized (fig. 139, 141, 150, 151, 160, and 161); P. F. a right rhombic prism of about 100° and 80° ($102^{\circ} 30'$ and $77^{\circ} 30'$, Beud.).

Before the blow-pipe it fuses with great and continued bubbling (but without previous intumescence) into a very blebby colourless or green glass.

C. P. Silica 44.10, alumina 25.26, lime 26.43, oxide of iron 0.74, water 4.18, *Walmstedt*.

P. L. Cape of Good Hope; Dauphiné, with axinite, &c.; Val di Fassa, Tyrol; Arendal in Norway; Dumbarton and other parts of Scotland, &c., in primitive and trap rocks.

Note.—All the minerals of the above group form easily a jelly in acids.

Group II.

DAVYNE.

H.=5.0—5.5; Sp. gr. 2.3—2.4. It occurs crystallized (fig. 106).

P. F. a rhombohedron.

Fusible with previous intumescence.

See Div. II, Sec. 6, A (Gr. 3).

ELAOLITE.

Id. Phil.; Nepheline (in part), *Beud.*; Fettstein, *W.*

H.=5.5—6.0; Sp. gr. 2.5—2.62; C. green, bluish-green, dull-red, the two former possessing a greater or less degree of opalescence; Sk. white; L. resinous. It occurs massive. Cleavage form, a right rhombic prism of about 112° and 68° .

Easily fusible, with slight bubbling, into a blebby white glass.

C. P. Silica 44.19, alumina 34.42, soda 16.87, potassa 4.73, with minute portions (about 0.50 per cent.) of lime, magnesia, and the oxides of manganese and iron, *Gmelin*.

P. L. Laurvig, Stavern, and Fredericswårn in Norway, in the zircon-syenite of that country, with magnetic iron ore, feldspar, &c.

Note.—This substance is united by several mineralogists with nepheline, to which it is certainly closely allied. The old analysis of Klaproth gave, however, a totally different composition in regard to the alkali. It is subjoined.

Silica 46.50, alumina 30.25, potassa 18.00, lime 0.75, oxide of iron 1.00, water 2.00 (*soda* 0.00).

NEPHELINE.

Id. Beud., Phil.; Rhombohedral Feldspar, *M.*; Sommite.

H.=6·0; Sp. gr. 2·5—2·6 (2·76, Beud.); C. white, greyish; L. vitreous; T. 2, 4. It occurs massive, and crystallized (fig. 98, 105, 106). P. F. the regular six-sided prism.

Fusible into a blebby glass.

C. P. Silica 44·11, alumina 33·73, soda 20·46, *Arfwedson*.

P. L. Monte Somma, Vesuvius, with idocrase, mica, &c., in the ejected masses of dolomite; Capo di Bove near Rome, in ancient lava; Katzenbuchel near Heidelberg, in basalt. It is the variety from this latter place, containing 7·13 per cent. of potassa (Gmelin), which resembles the Elaeolite in composition.

ITTNERITE.

Id. Phil., Beud. (Appendix to the Nepheline).

H.=5·5—6·0; Sp. gr. 2·3; C. grey, bluish-grey; Sk. white. It occurs in imbedded rhomboidal dodecahedrons (fig. 28), the primary form.

Fusible, with intumescence and effervescence, into a very blebby glass.

C. P. Silica 30·016, alumina 28·400, soda 11·288, lime 5·235, potassa 1·565, water 10·759, traces of hydrosulphuric acid, oxide of iron 0·616, gypsum 4·891, common salt 1·618, *Gmelin*.

L. Kaiserthul in the Brisgau, in Basalt.

EUDYALITE.

H.=5·0—5·5; Sp. gr. 2·89; C. red, brownish-red.

See Div. II, Sec. 6, A (Appendix to Gr. 4).

HAUYNE.

Id. Beud., Phil.; Dodecahedral Kouphone Spar (in part), *M.*; Latialite, *H.*

H.=6·0; Sp. gr. 2·68—3·0; C. blue, bluish-green; Sk. white; L. vitreous. It occurs in small granular masses and crystals (fig. 28). P. F. the rhombic dodecahedron.

Fusible into a blebby glass, and giving with soda (or glass of soda and silica) the yellow and red colour indicative of sulphur.

C. P. Silica 35·48, alumina 18·87, potassa 15·45, lime 12·00, sulphuric acid 12·39, oxide of iron 1·16, water 1·20, traces of sulphuretted hydrogen, *Gmelin*.

P. L. Vesuvius, Capo di Bove near Rome, Andernach on the Rhine, Cantal, &c., in ejectic volcanic rocks, lava, and pumice.

LAZULITE.

Outremer, *Beud.*; Lapis-Lazuli, *Phil.*; Dodecahedral Kouphone Spar (in part), *M.*; Azure-stone.

H.=5·5—6·0; Sp. gr. 2·76—2·95; C. blue; Sk. white; L. glimmering. It occurs massive, very rarely crystallized (fig. 28).

P. F. the rhombic dodecahedron.

Fusible into a white blebby glass, when pure; the impure varieties giving a glass more or less coloured by iron. With soda (like the Hauyne, see above) it indicates the presence of sulphur.

C. P. Silica 49, alumina 11, potassa and soda 16, oxide of iron 4·0, sulphuric acid 2·0, with traces of water, *Gmelin*.

P. L. Persia, China, Siberia (near Lake Baikal), &c., generally mixed with quartz, iron-pyrites, feldspar, and carbonate of lime; its value thereby being much deteriorated.

SPINELLANE.

Id. Beud., Phil.; Dodecahedral Kouphone Spar (in part), *M.*; Nosine.

H.=5.5—6.0; Sp. gr. 2.28; C. grey; Sk. white. It occurs in small crystals (fig. 109). P. F. the rhomboidal dodecahedron. Fusible into a blebby white glass. Giving, with soda, the reactions of sulphur.

C. P. Silica 38.50, alumina 29.25, soda 16.56, sulphuric acid 8.16, water 3.00, with about 1.0 per cent. of lime and the oxides of iron and manganese, *Bergmann*.

L. Lake Laach near Andernach on the Rhine, with glassy feldspar, hornblende, &c.

SODALITE.

Id. Beud., Phil.; Dodecahedral Kouphone Spar (in part), *M.*

H.=5.5—6.0; Sp. gr. 2.37—2.49; C. white, pale-green, pale bluish-green; Sk. white. It occurs massive and crystallized (fig. 28). P. F. the rhomboidal dodecahedron.

Fusible only on the edges.

C. P. Silica 35.99, alumina 32.59, soda 26.55, hydrochloric (*muratic*) acid 5.30, *Arfwedson*.

P. L. Vesuvius, with augite, &c.; Greenland, with eudyalite and other minerals.

MELLILITE.

Id. Phil., Beud.

H. about 6.5; Sp. gr. 3.24—3.28; C. pale or deep-yellow; Sk. white; L. vitreous; opaque. It occurs in small crystals (fig. 36, 37). P. F. a right square prism.

Fusible into a greenish glass.

C. P. Silica 38.0, lime 19.6, magnesia 19.4, alumina 2.9, oxide of iron 12.1, oxide of manganese 2.0, oxide of titanium 4.0, *Carpi*.

L. Capo di Bove, near Rome, in lava with nepheline, &c.

SPHENE.

H.=5.0—5.5; Sp. gr. 3.4—3.6. P. F. an oblique rhombic prism of 133° 30' and 46° 30'.

Fusible (with continued bubbling) on the edges and surface into a dark enamel.

See Div. II, Sec. 6, A (Gr. 3).

LABRADORITE.

Id. Beud., Phil.; Polychromatic Feldspar, *M.*; Labrador Feldspar; Lime Feldspar.

H.=6.0; Sp. gr. 2.69—2.75; C. grey, with beautiful opalescent tints of blue, green, yellow, red, &c.; Sk. white. It occurs massive, and very rarely in rough imperfectly-formed crystals. P. F. an oblique rhombic prism of 119° and 61°.

Fusible into a blebby glass. Forms (when in powder) a gelatinous mass in heated hydrochloric (*muratic*) acid.

C. P. Silica 55.75, alumina 26.50, lime 11.00, soda 4.00, oxide of iron 1.25, water 0.50, *Klapr.*

P. L. The coast of Labrador; Finland (on the banks of the Neva); Greenland, in primitive rocks. It is also said to form the base of certain basalts in Hessa, &c.

ANORTHITE.

Id. Beud., Phil.; Anorthotomous Feldspar, *M.*; Christianite.

H.=6.0; Sp. gr. 2.65—2.78; C. white; Sk. white; T. 3, 4. L. vitreous, vitreo-pearly. It occurs crystallized (fig. 245, &c.).

P. F. an oblique rhombic prism.

Fusible into a blebby glass. Forms a gelatinous mass, or is almost entirely soluble, in heated hydrochloric acid.

C. P. Silica 44.49, alumina 34.46, lime 15.68, magnesia 5.26, oxide of iron 0.74, *Rose*.

L. Monte Somma (Vesuvius), with Nepheline, Pleonaste, &c.

ALLANITE.

Id. Phil.; Appendix to Cerine, *Beud.*; Anorthitic Melane Ore (in part), *Haid.*; Cerin, *His.* and *Berz.*

H.=5.5—6.0; Sp. gr. 3.2—4.0; C. brownish-black; Sk. greenish-grey; opaque; L. imperfect metallic. It occurs massive, and very rarely crystallized in oblique four-sided prisms.

Fusible, with bubbling, into a shining black globule. With the fluxes it gives the reactions of cerium (see Chapter I).

C. P. Silica 33.02, protoxide of cerium 21.60, oxide of iron 15.10, alumina 15.23, lime 11.08, water 3.00, *Strom.*

P. L. Alluk, East Greenland, in granite. The copper mine of St Görans, near Riddarhyttan, in Sweden (Cerine).

Appendix.

ORTHITE.

(From Sweden and Norway).

In prismatic concretions; C. grey, brownish-black; Sk. brownish-grey; L. vitreous.

Fusible, with intumescence and bubbling, into a black blebby globule.

C. P. Silica 36.25, protoxide of cerium 17.39, alumina 14.00, oxide of iron 11.42, oxide of manganese 1.36, lime 4.89, yttria 3.80, water 8.70, from Finbo, *Berz.*

It occurs in granite.

Pyrorthite. See Div. II, Sec. 3 (Gr. 2).

GADOLINITE.

Id. Beud., Phil.; Prismatic Gadolinite, *M.*; Prismatic Melane Ore, *Haid.*

H.=6.5—7.0; Sp. gr. 4.2—4.3; C. black; Sk. greenish-grey; Fr. conchoidal, and shining with a vitreous lustre. It has a slight (though sensible) action on the magnet, and occurs in small masses, dull externally, and generally surrounded with a yellowish crust, also, though very rarely, in imperfect oblique rhombic prisms of 115°.

Fusible, with intumescence, into an opaque yellowish globule.

C. P. Silica 25.80, yttria 45, oxide of cerium 17.92, oxide of iron 11.43, *Berz.*

P. L. Finbo and Karafvet, near Fahlun, and Ytterby, near Stockholm, in Sweden, in coarse granite.

LIEVRITE.

Ilvaite, *Beud.*; Yenite, *Phil.*; Diprismatic Iron Ore, *M.*; Lievrit, *W.*

H.=5.5—6.0; Sp. gr. 3.8—4.1; C. brown, brownish-black; Sk. black, with a slight shade of brown; L. sometimes imperfect metallic. It occurs massive, in radiated concretions, and in crystals striated longitudinally (fig. 163, 164, 172, and 172 a).

P. F. a right rhombic prism of 111° 30' and 68° 30'.

Fusible into a black and strongly magnetic globule. With the fluxes it gives the reactions of iron.

C. P. Silica 28, protoxide of iron 55, protoxide of manganese 3, lime 12.0, alumina 0.6, *Descotils.*

P. L. Rio la Marino and Cape Calmite in Elba, with augite, &c., in primitive limestone; Fossum, in Norway; Silesia, &c.

Group III.

WERNERITE.

H.=5.0—5.5; Sp. gr. 2.5—2.8; P. F. a square prism.
Easily fusible, with bubbling, into a blebby white glass.
See Division 2, Section 6, A (Group 3).

SAUSSURITE.

Id. Phil. Albite (in part), *Beud.*; Prismatic Nephrite Spar, *Haid.*

H.=5.5; Sp. gr. 3.2—3.4; C. light-green, grey; Sk. white; slightly unctuous to the touch. It occurs massive, but is not a very distinct mineral.

Fusible into a colourless glass, more or less blebby.

C. P. Silica 49, alumina 24, lime 10, magnesia 3.75, oxide of iron 6.50, soda 5.50, *Klapr.*

P. L. The shores of the Lake of Geneva, in rounded masses; Corsica, &c., with hornblende, in primitive rocks.

AMBLYGONITE.

Id. Phil., Beud.; Amblygonic Augite Spar, *Haid.*

H.=6.0; Sp. gr. 2.9—3.05; C. light-green; Sk. white; L. vitreous; T. 2, 3. It occurs in small masses, and also in rhombic prisms of 106° 10' and 73° 50'.

Fusible easily into a clear glass, which, on cooling, becomes opaque. It dissolves *entirely* in the microcosmic salt, by which character alone it might be distinguished from the other minerals of this Section.

C. P. Phosphoric acid 54.12, alumina 38.96, lithia 6.92, *Berz.*

P. L. Chursdorf, near Penig, in Saxony, and Arendal, in Norway, in granite, with tourmaline, topaz, augite, and garnets.

RHODONITE. SILICATE OF MANGANESE.

Rhodonite, *Beud.*; Siliceferous Oxide of Manganese, *Phil.*; Manganese Spar; Allagite, Photizite, &c.

H.=5.5—6.0; Sp. gr. 3.5—3.9; C. pale-red; Sk. white; T. 1. It occurs massive. P. F. a doubly oblique prism, yielding angles of 112° 30', 121°, and 93° 30' (about), in different directions.

Fusible, with more or less bubbling, into a black globule in the O. F., and into a yellowish or reddish one in the R. F. Giving with soda on the platina wire, strong reactions of manganese.

C. P. Silica 48.00, protoxide of manganese 49.04, lime 3.12, magnesia 0.22, *Berz.*

P. L. Siberia, Sweden, the Hartz, Devonshire, &c., in primitive rocks.

Appendix.

OPSIMOSE.

Optimose (*Beud.*), black, with a semi-metallic aspect; Sk. brownish-yellow. Giving off water in the matrass.

Fusible into a black or green glass, and yielding with soda the reaction of manganese. (H. about 5.5.)

C. P. Silica 25, protoxide of manganese 60, water 13, *Klapr.*

L. Dalecarlia, Sweden; Hungary.

MARCELINITE.

Marceline (*Beud.*); H. about 5.0; Sp. gr. 3.8; C. greyish-black; L. slightly semi-metallic, or vitreous. It occurs in octahedrons with square bases.

Fusible, without giving off water, and presenting the reactions of manganese.
C. P. Silica 15·17, oxide of manganese 75·80, oxide of iron 4·14, alumina 2·80,
Berz.

L. St Marcel, in Piedmont.

HORNBLLENDE.

H.=5·0—6·0; Sp. gr. 2·7—3·2; Sk. greyish-white, or very pale-brown. P. F. an oblique rhombic prism of about $124^{\circ} 30'$.

Fusible, with more or less bubbling.

Appendix.

ARFVEDSONITE.

H.=6·0; Sp. gr. 3·4—3·5; C. black; Sk. greyish-white.

See Div. II, Sec. 6, A (Gr. 3).

AUGITE.

H.=5·0—6·0; Sp. gr. 3·1—3·5; P. F. an oblique rhombic prism of $87^{\circ} 5'$ and $92^{\circ} 55'$.

Fusible, with more or less bubbling.

Appendix.

BABINGTONITE.

H.=5·5—6·0; Sp. gr. 3·4—3·5; C. dark greenish-black (fig. 264).

BUCKLANDITE.

H. above 5·5; Sp. gr. 3·94 (fig. 232 *a.*)

See Div. II, Sec. 6, A (Gr. 3).

HELVINE.

Id. Beud., Phil.; Tetrahedral Garnet, *M.*

H.=6·0—6·5; Sp. gr. 3·1—3·3; C. yellow, greenish-yellow; Sk. white; T. 1; L. resino-vitreous. It occurs in imbedded grains and small crystals (fig. 2). P. F. the regular tetrahedron.

Fusible, with bubbling, into an opaque yellowish globule, and presenting, with soda, &c., the reactions of manganese.

C. P. Silica 35·271, glucina 8·026, alumina 1·445, protoxide of manganese 29·344, protoxide of iron 7·990, sulphuret of manganese 14·000, *Gmelin.*

P. L. Near Schwartzenberg in Saxony, with fluor, blende, &c., in gneiss; also near Modum, in Norway.

HYPERSTHENE.

Id. Beud., Phil.; Prismatic Schiller Spar, *M.*; Paulite; Labrador Hornblende.

H.=6·0; Sp. gr. 3·3—3·4; C. dark pinchbeck-brown, greenish-black; Sk. greyish; L. semi-metallic, pearly; T. 0. It occurs in granular and lamellar concretions. P. F. a rhombic prism of about 98° and 82° .

Fusible, with slight bubbling, into a dark glass.

C. P. Silica 54·25, magnesia 14·00, oxide of iron 24·50, lime 1·50, alumina 2·25, water 1·00, *Klapr.*

P. L. Labrador (chiefly at the Island of St Paul's), in syenitic rocks; Greenland.

FELDSPAR, OR FELSPAR.

Felspar, *Phil.*; Feldspath, Orthose, *Beud.*; Prismatic Feldspar, *M.*; Adularia; Orthoclase; Potash Feldspar.

H.=6·0; Sp. gr. 2·5—2·8; C. white, grey, red, green (amazon stone); Sk. white; L. pearly, vitreous. It occurs massive, in

lamellar and granular concretions, and crystallized (fig. 212, 212a, frequently maced). P. F. a doubly oblique prism, presenting angles of $59^{\circ} 25'$ and $120^{\circ} 35'$ in one direction; and of 90° and $67^{\circ} 15'$, and $112^{\circ} 45'$, in other directions.

Fusible *per se* into a white blebby glass.

C. P.	Adularia.	Red common F.
Silica	64.20	65.03
Alumina	18.40	17.96
Potassa	16.95	16.21
Lime . . . . .	. . . . .	0.35
Peroxide of iron . . . . .	. . . . .	0.47
	<i>Berthier.</i>	<i>Beudant.</i>

P. L. Cornwall, Devonshire, Scotland; Bohemia; Silesia; France; Norway; Siberia, &c. &c., in primitive rocks, of which it often forms an essential ingredient.

Note.—The green variety termed “Amazon Stone,” comes from the Ural Mountains, Siberia, and an iridescent variety occurs in Norway, to which the name of “Norwegian Labrador” has been given, although it is perfectly distinct from the Labradorite or Lime Feldspar.

Appendix.

ICE-SPAR.

In small white flattish crystals. P. F. a right oblique-angled prism; L. vitreous.

Fusible into a white blebby glass.

It occurs at Vesuvius, in cavities of ejected rocks.

GLASSY FELDSPAR (Ryakolite).

In small greyish-white crystals cracked all over; transparent or translucent, with a vitreous lustre.

It occurs in trachytic rocks at Drachenfels on the Rhine; Bohemia, &c.; also in ancient lava.

ALBITE.

Id. Beud., Phil.; Tetarto-Prismatic Feldspar, *M.*; Tetartin; Cleavelandite; Soda Feldspar.

H.=6.0; Sp. gr. 2.6—2.7; C. white, grey, red, greenish; Sk. white; L. pearly, vitreous. It occurs massive and crystallized (fig. 244, 245), the crystals being generally maced. P. F. an oblique rhombic prism.

Fusible into a white blebby glass.

C. P. Silica 68.65, alumina 19.91, soda 9.12, *Rose*.

P. L. St Gothard, Dauphiné, the Tyrol, Arendal in Norway, Ireland, &c., in primitive rocks; also near Edinburgh, and other places, forming an essential ingredient in greenstone rocks.

Appendix.

PERICLINE.

(Heterotomous Feldspar, *M.*)

H.=6.0; Sp. gr. 2.54—2.56; in white twin crystals, closely resembling those of Albite.

Fusible into a blebby glass.

C. P. Silica 67.94, alumina 18.93, soda 9.98, potassa 2.41, lime 0.15, *Gmelin*.

P. L. The Tyrol, St Gothard, Bohemia, &c.

PETALITE.

Id. Beud., Phil.; Prismatic Petaline Spar, *M.*; Berzelite.

H.=6.0—6.5; Sp. gr. 2.4—2.5; C. white, pale-reddish; Sk. white; L. 2, vitreo-pearly. It occurs in lamellar masses.

Fusible *per se*, without difficulty, into a blebby glass. It communicates to the flame too weak a tinge to be characteristic.

C. P. Silica 79·21, alumina 17·22, lithia 5·76, *Arfw.*

L. Uton in Sweden, with spodumene, tourmaline, &c., in a mine of magnetic iron.

SPODUMENE, OR TRIPHANE.

Triphane, *Beud.*; Spodumene, *Phil.*; Prismatic Triphane Spar, *M.*; Zéolite de Swède.

H.=6·5—7·0; Sp. gr. 3·0—3·1; C. light-green, greenish-white; weak, slightly pearly lustre. It occurs in lamellar masses.

P. F. a rhombic prism of about 160° and 80°.

Before the blow-pipe it exfoliates into fibres, each of which melts easily into a nearly clear glass, but it requires a long-continued blast to unite them into one globule.

During fusion, the point of the blue flame takes a purplish-red tinge, which is always very perceptible, and often intense.

C. P. Silica 66·40, alumina 25·30, lithia 8·85, oxide of iron 1·45, *Arfw.*

P. L. The Island of Uton, with the above; Sterzing, Lysens, &c., in the Tyrol; Killiney near Dublin, with killinite in granite.

OBSIDIAN (INCLUDING PITCHSTONE, &c.)

Obsidienne, Marekanite, Retinite, *Beud.*; Obsidian, Pitchstone, Pearlstone, &c., *Phil.*; Empyrodiox Quartz, *M.*; Fusible Quartz, *J.*

H.=6·0—7·0;* Sp. gr. 2·2—2·5; C. black, grey, brown, green, red, bluish, white, &c.; Sk. white; L. vitreous (Obsidian), dull, resinous (Pitchstone), and pearly (Pearlstone, Pumice); Fr. conchoidal, uneven, splintery. It occurs massive, globular, vesicular, fibrous. No cleavage.

Fusible (with more or less bubbling) into a colourless or greenish blebby glass.

C. P.	(1)	(2)	(3)
Silica	81·00 . .	73·00 . .	77·00
Alumina	9·50 . .	10·84 . .	13·00
Soda	4·50 . .	1·48 } . .	2·70
Potassa	2·70 . .	— } . .	
Lime	0·33 . .	1·14 . .	1·50
Oxide of Iron . .	0·60 . .	1·90 . .	2·00
Bituminous matter	— . .	9·40 . .	—

(1). Transparent Obsidian, by Klaproth.

(2). Pitchstone, from Meissen in Saxony, by Dumenil.

(3). Pearlstone (Perlite from Mexico), by Vanquelin.

P. L. Iceland, the Lipari Isles, Siberia, Mexico, Hungary, &c., in trachytic and volcanic regions (Obs., Pearls, Pumice). Also Saxony, &c., in sandstones of the carbonaceous series, and Arran, in granite. (Pitchstone.)

SPHERULITE.

Id. Breithaupt, Phil.; Sphérolite, *Beud.*

H.=6·5—7·0; Sp. gr. 2·4—2·55; C. grey, yellow, brown, sometimes covered with a reddish crust; L. vitreous, but feeble. It occurs in small imbedded nodules, often with botryoidal surfaces. These nodules are sometimes compact, sometimes formed of radiated fibrous concretions. No apparent cleavage.

Fusible *per se*, but less easily than Obsidian, into a blebby glass.

* Less in the fibrous varieties.

C. P. Silica 79·12, alumina 12·00, potassa and soda 3·58, protoxide of iron 2·45, water 1·76, *Ficinus*.

P. L. Glashutte, by Schemnitz in Hungary, in grey pearlstone; Spechts-hausen, near Tharand in Saxony, in blackish pitchstone; also in Brit-tany, &c.

Its composition agrees with that of the Obsidian, from which species it has been perhaps unnecessarily separated.

ISOPYRE.

Id. Beud., Phil.; Isopyric quartz, *Haid.*; Trachylite (?), *Breith*.

H.=6·0—6·5; Sp. gr. 2·9—3·0; C. black, sometimes with red spots; Sk. white; L. vitreous; Fr. large conchoidal. It occurs in small uncleavable masses, which slightly affect the magnetic needle.

Fusible into a blebby glass.

C. P. Silica 47·09, alumina 13·91, peroxide of iron 20·07, lime 15·43, oxide of copper 1·94, *Turner*.

P. L. St Just, Cornwall, in granite. The Trachylite occurs in basalt, near Göttingen.

AXINITE.

Id. Beud., Phil.; Prismatic Axinite, *M.*; Thumerstone; Yanolite; Schorl Violet.

H.=6·5—7·0; Sp. gr. 3·0—3·3; C. clove-brown, violet, grey, some-times green from intermixed earthy chlorite; Sk. white; L. vitreous. It occurs massive, but more generally in groups of sharp-edged flat crystals (fig. 239 to 242). P. F. an oblique rhomboidal prism of $135^{\circ} 10'$ and $44^{\circ} 50'$. Inclination of the base on the sides, $134^{\circ} 40'$, &c., and $115^{\circ} 17'$, &c.

Fusible, with great bubbling, into a dark glass. With soda on the platina wire it gives indications of manganese.

C. P. Silica 45, alumina 19, lime 12·50, magnesia 0·25, oxide of iron 12·25, oxide of manganese 9·00, boracic acid 2·00, *Wiegmann*.

P. L. Dauphiny, Norway, Thum in Saxony, Cornwall, the Pyrennees, &c., in veins in primitive rocks.

THALLITE, OR EPIDOTE (INCLUDING ZOIZITE).

Epidote, Thallite, Zoizite, *Beud.*; Zoizite, Epidote, *Phil.*; Prismatoidal Augite Spar, *M.*; Pistazite, Arendalite, Acanticone, Delphinite, Scorza.

H.=6·0—7·0; Sp. gr. 3·2—3·5; C. green, brown (Thallite), grey (Zoizite); Sk. greyish-white. It occurs in fibrous and pris-matic concretions, in small granular particles (Scorza), and crys-tallized (fig. 236 to 241); the crystals in general, longitudinally striated. P. F. a right oblique-angled prism, of about $115^{\circ} 30'$ and $64^{\circ} 30'$.

Before the blow-pipe it curls up into a dark-brown ramified mass, which becomes rounded on the edges, but resists further fusion.

C. P. Silica 37, alumina 27, lime 14, oxide of iron 17, oxide of manganese 1·5, *Descotils*.

P. L. Arendal in Norway, Dauphiny, the Tyrol, Gefrees Bavaria (Zoi.), Styria, &c., in primitive rocks.

Appendix.

THULITE.

H.=6·0; in small rose-red crystalline groups; P. F. a rhombic prism of $92^{\circ} 30'$, &c.

C. P. Silica 42·5, alumina 25·1, lime 19·4, magnesia 0·6, *Beud.*

L. Tellemarken in Norway, with quartz, fluor, and cyprine.

MANGANESIAN EPIDOTE.

Three varieties are described which may be arranged under this title.

MANGANESIAN EPIDOTE.

C. violet, reddish-brown; in small groups of prismatic crystals. With soda on the P. W. it gives the reactions of manganese.

It occurs at St Marcel, in Piedmont, with asbestos, &c.

WITHAMITE.

H.=6.0—6.5; Sp. gr. 3.1—3.3; C. red; L. vitreous; Sk. white. It occurs in small masses, and minute crystals, in trap rocks in Argyleshire. With soda on the P. W. it gives the reactions of manganese.

CUMMINGTONITE.

Sp. gr. 3.2; C. greyish-white; L. rather pearly. It occurs in small groups of minute divergent crystals, at Cumington, N. A., in granite. It contains silica, soda, and the protoxides of iron and manganese, according to the analysis of Thomson.

IDOCRASE, OR VESUVIAN.

Idocrase, *Beud., Phil.*; Pyramidal Garnet, *M.*; Vesuvian, Egerane; Loboite; Frugardite; Cyprine; Wilouite.

H.=6.5; Sp. gr. 3.0—3.4, usually about 3.3; C. brown, green, yellowish, black, blue (Cyprine); L. vitreo-resinous, feeble internally. It occurs massive, and crystallized (fig. 37, 42, 43, and 44). P. F. a right square prism. The crystals are generally longitudinally striated.

Fusible, with great bubbling, into a yellowish blebby glass; the blue varieties (Cyprine) give indications of copper.

C. P. Silica 36, alumina 17.50, lime 37.65, magnesia 2.52, protoxide of iron 5.55, volatile matters 0.36,* *Berz.*

P. L. Vesuvius, in the ejected rocks; Siberia, Piedmont, Norway, Bohemia (near Eger, in brown divergent groups, *Egerane*), &c., in primitive rocks. The cyprine or cupreous idocrase occurs at Tellemarken in Norway.

GARNETS.

Garnet, *Phil.*; Dodecahedral Garnet, *M.*

H.=6.5—7.5; Sp. gr. 3.35—4.25; Sk. white. P. F. the rhomboidal dodecahedron.

Fusible (sometimes with bubbling), into a bead, which is generally magnetic.

See Section 2, A, of this Division.

Appendix to the Sub-section.

SOMMERVILLITE.

(From Vesuvius.)

H. about 5.5; C. pale-yellow; L. vitreous. P. F. a right square (?) prism. Decrepitates before the blow-pipe, and fuses into a greyish glass. It is generally considered, and with seeming propriety, to be a variety of Idocrase.

PHENAKITE.

(From Siberia.)

H. about 6.5 or 7.0; Sp. gr. 2.969; C. wine-yellow; L. vitreous. P. F. a rhomboid of 115° 25'.

Difficultly fusible.

C. P. Silica 55.14, glucina 44.47, alumina and magnesia 0.39, *Hartwall*.

See 'Phillips's Min.' 4th ed.

* Some varieties contain also minute portions of protoxide of manganese.

TAUTOLITE.

(From Laach, near Bonn, on the Rhine.)

H.=6·5—7·0; Sp. gr. 3·865; C. black; Sk. greyish-white; L. vitreous; opaque. Cleavage very indistinct.

Fusible into a magnetic scoria.

C. P. Silica, protoxide of iron and alumina (?).

See 'Phillips's Min.' 4th ed.

SECTION I.

B.

Remarks.—The minerals of this latter Sub-section are arranged in the three following groups:—

- Group 1. Comprising those substances, which, when fused with borax, yield a glass that may be rendered opaque and milky by flaming, or which becomes so on cooling.
- Group 2. Comprising those substances which do not present the above effect, when fused with borax, but which have a colourless or white streak.
- Group 3. Comprising those substances which also do not form an opaque glass with borax, but which possess a coloured streak.

Group I.

CERITE. SILICATE OF OXIDE OF CERIUM.

Cerite, *Phil.*; Cericite, *Beud.*; Rhombohedral Cerium Ore, *M.*

H.=5·5; Sp. gr. 4·9—5·0; C. rose-red, passing into brownish or grey; Sk. white; T. 0, or faintly 1. It occurs massive, in dull granular concretions.

Infusible. Gives off water in the matrass, and produces, with the fluxes, the reactions of cerium (see Chapter I).

C. P. Silica 18·00, oxide of cerium 68·59, oxide of iron 2·00, lime 1·25, water 9·60, *Hisinger*.

L. Bastnaës, near Riddarhyttan, in Sweden, in gneiss, with copper-pyrites, sulphuret of bismuth, mica, actynolite, &c. It is a rare mineral.

YTTROCERITE.

H. between 4·5 and 7·0 (5·0 Thomson); Sp. gr. 3·4—4·15; C. violet, reddish. Occurs massive.

Infusible *per se*; melts *entirely* in microcosmic salt, the globule, when saturated, becoming opaque.

See Div. II, Sec. 7, A (Gr. 1).

MICROLITE.

H.=5·0—5·5; Sp. gr. 4·75—5·0; C. yellow, brown; Sk. white or brownish.

Infusible.

See Div. II, Sec. 7, A (App. to Gr. 1).

COLUMBITE, or TANTALITE.

Columbite and Baierine, *Beud.*; Tantalite, *Phil.*; Prismatic Tantalum Ore, *M.* H.=6.0 (or 5.5—6.0); Sp. gr. 6.0—8.0;* C. black; Sk. brownish-black; opaque; L. adamantine, or imperfect metallic. It occurs massive, and in small flat imperfect crystals, striated longitudinally. P. F. a right rectangular prism (?).

Infusible; giving with soda, on the platina wire, the reaction of manganese.

C. P.	(1)	(2)	(3)
Columbic acid	68.22	75.0	80.0
Protoxide of iron	9.58	20.0	15.0
Protoxide of manganese	7.15	4.0	5.0
Oxide of tin	8.26	0.5	0.0
Lime	1.19	0.0	0.0
Tungstic acid	6.19	0.0	0.0

(1) From Broddbo; *Berz.*

(2) From Bodenmais in Bavaria; *Borkowsky.*

(3) From America; *Wollaston.*

P. L. Bodenmais in Bavaria, with Iolite and Beryl; Broddbo and Finbo in Sweden; Kimmito in Finland; and in Connecticut and Massachusetts, North America, in granitic rocks; but it is still a scarce mineral.

YTTRIO-COLUMBITE.

H.=4.5—5.5; Sp. gr. 5.0—5.9; C. yellow, dark brown, black; Sk. white or grey.

Infusible, decrepitates.

See Div. II, Sec. 7, A (Gr. 1).

FERGUSONITE.

Id. Phil., Haid., &c.

H.=5.5—6.0; Sp. gr. 5.8—5.9; C. brownish-black; Sk. pale brown; L. 4, vitreous, on the fresh fracture. It occurs in pyramidal crystals with truncated summits, having for their P. F. an octahedron whose terminal edges† meet together at an angle of 100° 28', and the lateral edges at an angle of 128° 27'.

Infusible alone.

C. P. Columbic acid 47.75, yttria 41.91, protoxide of cerium 4.68, zirconia 3.02, oxide of tin 1.00, oxide of uranium 0.95, peroxide of iron 0.34, *Victor Hartwall.*

L. Kikertausak, near Cape Farewell, in Greenland, imbedded in white quartz. It is exceedingly rare.

ANATASE.

Id. Beud., Phil.; Pyramidal Titanium Ore, *M.*; Octahedrite; Oisanite; Blue Schorl.

H.=5.5—6.0; Sp. gr. 3.8—3.9; C. brown, blue, by transmitted light yellowish; Sk. white; L. 4, adamantine, sometimes semi-metallic. It occurs crystallized (fig. 56, 58, 59, 60 a). P. F. an acute octahedron with square base.

Infusible alone; with the fluxes it gives the reactions of titanium.

* The Sp. gr. of this mineral, as stated by different mineralogists, varies exceedingly. Möhs makes it 6.038 (from Bavaria); Allan 6.3—6.8; Berzelius 7.236—7.655; Ekeberg 7.963. I have only had an opportunity of trying two specimens, both, I believe, from Bavaria; their respective specific gravities were under 6.3.

† Forming the common base of the pyramids.

C. P. Protoxide of titanium.

P. L. Oisans in Dauphiné, with axinite, chlorite, &c., in granite and mica-slate. Also, St Gothard, Selvaz, &c., in the Grisons; the Pyrenees; Spain; Norway, and Brazil, likewise in primitive rocks.

RUTILE.

Id. Beud., Phil. (in part); Peritomous Titanium Ore (in part), *M.*; Titanite; Crispite; Sagenite; Titan Schorl.

H.=6.0—6.5; Sp. gr. 4.2—4.3; C. brown, dark-red, yellowish; Sk. pale-brown; L. adamantine, sometimes semi-metallic. It occurs massive, and in crystals (fig. 38, 54 a, &c.), sometimes of considerable size, but often acicular, and then reticulated, or forming divergent groups.* P. F. a right square prism.

Infusible alone; giving with the fluxes the reactions of oxide of Titanium.

C. P. Oxide of titanium (oxygen 33.95, titanium 66.05), but it is rarely quite pure, being generally mixed with the oxides of iron, manganese, and (occasionally) chrome.

P. L. St Gothard, on specular iron; the Tyrol, Piedmont, Hungary, Arendal in Norway, Sweden, St Yriex, &c., in France, Castile, Pennsylvania, &c., in North America, Perthshire in Scotland, Brazil, in granite, mica-slate, and other primitive rocks, with quartz, chlorite, cyanite, aimantine, &c.

BROOKITE.

Id. Beud., Phil., &c.; Prismatic Titanium Ore.

H.=5.5—6.0; C. hair-brown, orange-yellow; Sk. yellowish-white; L. metallic-adamantine. It occurs in pointed, flat crystals, derived from a right rhombic prism of 100° and 80°.

Infusible alone; giving with the fluxes the reactions of oxide of titanium.

C. P. Chiefly oxide of titanium.

P. L. Bourg. d'Oisans in Dauphiné, Savoy, Snowden in Wales, in primitive rocks.

TITANIO FERRITE.

Under this title (as one of convenience for a time) I have placed the four following substances, which are arranged together by Beudant, under the name of Nigrine. In the descriptions of these substances scarcely two mineralogists will be found to coincide.

NIGRINE.

(Partly the Peritomous Titanium Ore, or Rutile, of the Möhs School.)

H.=6.0—6.5; Sp. gr. about 4.4; C. black; Sk. pale-brown; more or less attractable by the magnet, sometimes strongly so (although it is stated by Aiken and some other writers to be not magnetic); L. slightly inclining to semi-metallic, brilliant in the fracture. It occurs in small rolled pebbles.

Infusible alone, but after exposure to the blow-pipe it becomes greyish, and much less magnetic.

C. P. Oxide of titanium (titanic acid) 84, oxide of iron 14, oxide of manganese 2, *Klapr.*

P. L. Ohlapian in Transylvania, with gold, garnets, &c., in detritus of ancient rocks. Also Ceylon with hyacinths, &c., in alluvium; and Ely in Fife-shire.

* It also occurs in geniculated twin crystals. See the figure (p. 255) in 'Phillips's Mineralogy,' 4th ed.

MENACCANITE. (Gregorite.)

H. about 5·5; Sp. gr. about 4·4—4·5; C. black; Sk. greyish-black; L. inclining to semi-metallic. It occurs in the form of sand, or small crystalline grains; attractable by the magnet.

Infusible alone.

C. P. Titanic acid 58·7, protoxide of iron 36·0, protoxide of manganese 5·3, *Berthier*.

P. L. Menaccan, Cornwall, in the bed of a rivulet, and in the sand of the Isle of Siècles near Brittany.

ISERINE.

H. about 5·5; Sp. gr. 4·49—4·65; C. black; Sk. black; L. inclining to semi-metallic. It occurs in small flattish grains, more or less attractable by the magnet.

Infusible alone, or according to Thomson and Aiken, fusible into a brownish glass.*

C. P. Titanic acid 50·12, protoxide of iron 49·88, *Rose*.

P. L. The sands of the Iser in Bohemia, of the Don in Aberdeenshire, and of the Mersey on the Cheshire coast.

ILMENITE.

Id. Phil.; Axotomous Iron Ore, *M.*; Titaniferous Iron.

H.=5·0—5·5; Sp. gr. about 4·4—4·8; but that of an impure variety from Maisdon in France yielded to Berthier only 3·65, and according to Beudant, the Sp. gr. of this and the above substances (included under the name of Nigrine), varies from 3·26 to 4·89; C. black; Sk. black. L. imperfect metallic; attracts more or less the magnet. It occurs massive, and occasionally in irregular crystals derived from an acute rhomboid of 85° 59' and 94° 1'.

Infusible alone.

C. P. Titanic acid 59·00, protoxide of iron 36·00 peroxide of iron 4·25, protoxide of manganese 1·65, *Kobell*.

P. L. Ilmensee, &c., in Siberia, Eggersund in Norway, and in the Gastein Valley, Salzburg, in primitive rocks.

ÆSCHYNITE.

H.=5·0—5·0; Sp. gr. 5·1—5·5; C. black; Sk. dark grey or black; intumesces a little before the blow-pipe, but is infusible.

See Div. II, Sec. 7, B.

POLYMIGNITE.

Id. Beud., Phil., &c.

H.=6·5; Sp. gr. 4·77—4·85; C. black; Sk. dark-brown; opaque; L. imperfect metallic, brilliant. It occurs in thin rather long crystals, resembling fig. 130. P. F. a rhomboidal octahedron, *Rose* (see *Phillips's Min.* p. 262, 4th ed.).

Infusible alone.

C. P. Oxide of titanium 46·3, zirconia 14·4, yttria 11·5, oxide of iron 12·2, lime 4·2, oxide of manganese 2·70, oxide of cerium 5·0, *Berz.*

L. Stavern and Fredericksvarn in Norway, in the "zircon-syenite." It is a very rare mineral, and was first described and named by Berzelius.

* I have never met with any substance of this description which gave, *per se*, the least signs of fusion before the blow-pipe.

CONDRODITE.

H.=6·5 ; C. yellow, brown ; forms with borax a glass which, when saturated, becomes somewhat clouded by flaming.

See Group 2.

Group II.

ANTHOPHYLLITE.

H.=5·0—5·5 ; Sp. gr. 3·0—3·3 ; C. brown ; Sk. white ; L. metallic pearly.

Infusible.

See Div. II, Sec. 7, A (Gr. 2).

CHIASTOLITE.

H.=5·0—5·5 ; Sp. gr. 2·9—3·0 ; in crystals (fig. 265 and 266), generally rounded, and often acicular, imbedded in clay-slate.

Infusible.

See Div. II, Sec. 7, A (Gr. 2).

CALAITE, OR TURQUOISE.

H.=5·0—6·0 ; Sp. gr. 2·8—3·0 ; C. blue, bluish-green ; feeble lustre ; Sk. white ; no cleavage.

Infusible, gives off water in the matrass.

See Div. II, Sec. 7, A (Gr. 3).

KLAPROTHINE.

H.=5·0—6·0 ; Sp. gr. 3·0—3·1 ; C. blue ; Sk. white ; massive and rarely crystallized. P. F. a right rhombic prism.

Infusible, intumesces a little on the edges.

See Div. II, Sec. 7, A (Gr. 3).

SODALITE.

H.=5·5—6·0 ; Sp. gr. 2·37—2·49 ; C. pale bluish-green, white ; Sk. white. P. F. the rhomboidal dodecahedron.

Fusible only on the edges.

See A (Gr. 2) of this Section.

EPIDOTE, OR THALLITE.

H.=6·0—7·0 ; Sp. gr. 3·2—3·5 ; C. green, brown, grey (Zoizite) ; Sk. white. P. F. a right oblique-angled prism of about $115^{\circ} 30'$ and $64^{\circ} 30'$.

Before the blow-pipe it curls up into a dark ramified mass, which cannot be brought into a globule.

See A (Gr. 3) of this Section.

INDIANITE.

Id. Phil., Beud.; De Bournon.

H.=5·5—6·0 ; Sp. gr. 2·74 ; C. white, grey, reddish. It occurs massive. P. F. a rhombic prism of $95^{\circ} 15'$ and $84^{\circ} 45'$ (Brooke.)

Infusible (?) ; forms in heated acids a gelatinous mass.

C. P. Silica 43·0, alumina 34·5, lime 15·6, soda 2·6, oxide of iron 1·0, water 1·0, *Laugier.*

P. L. The Carnatic, with corundum, &c. It seems to be somewhat allied to the Labradorite.

LEUCITE.

Id. Phil.; Amphigene, *Beud.*; Trapezoidal Kouphone Spar, *M.*; Leucolite; White Garnet.

H.=5·5—6·0; Sp. gr. 2·4—2·5; C. greyish-white, yellowish, pale-reddish; Sk. white. It occurs in imbedded grains and crystals (fig. 35). P. F. the cube, or the rhombic dodecahedron, but the cleavage is imperfect.

Infusible *per se*, even in the thinnest splinter, or in powder.

C. P. Silica 56·10, alumina 23·10, potassa 21·15, oxide of iron 0·95, *Arfwedson*.

P. L. Vesuvius, in modern lava; Capo di Bove near Rome, Albano, Frascati, &c., in ancient lava; Andernach on the Rhine; Lipari, &c., in volcanic tufa.

CONDRODITE.

Id. Phil., *Beud.*; Hemi-prismatic Chrysolite, *M.*; Brucite; Maclureite.

H.=6·5; Sp. gr. 3·15—3·25; C. yellow, brownish; Sk. white; L. vitreous, but feeble. It occurs massive, and in small imbedded grains.

Infusible alone, but becomes white. With borax it melts into a glass, which, when well saturated, becomes clouded when flamed.

C. P. Silica 33·03, magnesia 44·33, fluorine 15·38, magnesium 9·06, forming silicate of magnesia 77·36, fluoride of magnesium 22·64, *Beud.*, *Berz.*

P. L. New Jersey and New York, N. A., in calc-spar with graphite; Pargas in Finland; Aker, &c. in Sweden, in calc-spar; Vesuvius (?).

DIASPORE.

Id. Phil.; Euklastic Disthene Spar, *Haid.*

H.=6·0—6·5; Sp. gr. 3·4324 (*Haüy*); C. greenish-grey; L. vitreopearly. It occurs massive, possessing a curved foliated texture, and also in delicate crystals, aggregated confusedly, or in a cellular manner. P. F. a doubly-oblique prism, measuring in different directions $64^{\circ} 54'$, $101^{\circ} 20'$, and $108^{\circ} 30'$, according to *Phillips*.

Infusible alone, but decrepitates violently, flying off in scaly particles. With microcosmic salt it dissolves *entirely*.

C. P. Alumina 76·06, oxide of iron (peroxide) 7·78, water 14·70, *Children*.

L. Believed to be in the Orenbourg Government of Asiatic Russia, but nothing very certain is known concerning it.

BUCHOLZITE.

Id. Phil., *Beud.*, *Thomson*, &c.

H.=6·0; Sp. gr. 3·193; C. greyish-white, with black spots; Sk. white; structure, fibrous, in some varieties not easily perceptible; L. pearly or silky.

Infusible alone.

C. P. Silica 46·40, alumina 52·92, *Dr Thomson*.

P. L. Fassa-thal in the Tyrol; Chester on the Delaware, N. A. It appears to be nearly allied to the Fibrolite.

GEHLENITE.

Id. Beud., *Phil.*, &c.; Stylobite.

H.=6·0—6·5, more rarely, 5·5; Sp. gr. 2·95—3·05; C. greyish-white, yellowish, pale greyish-green; L. 0 or 2. It occurs massive, and in small rectangular prisms (the P. F.) which appear like cubes.

Infusible *per se*; dissolves very slowly in borax.

C. P. Silica 29·64, alumina 24·80, lime 35·30, protoxide of iron 6·56, water 3·30, *Fuchs*.

L. Monzoni, Val di Fassa in the Tyrol, imbedded in calc-spar, or massive, containing crystals of Pleonaste.

SILLIMANITE.

Id. Phil., Beud., &c.

H.=6·0—6·5 (7·0?) ; Sp. gr. 3·41 ; C. grey or brown ; Sk. greyish-white ; L. vitreous (though often dull externally). It occurs in imbedded crystals, commonly twisted or curved. P. F. an oblique rhombic prism of $106^{\circ} 30'$ and $73^{\circ} 30'$. Infusible alone, and scarcely acted upon by borax.

C. P. Silica 42·67, alumina 54·11, oxide of iron 2·00, water 0·51, *Bowen*.*

L. Saybrook County, Connecticut, U. S., in quartz. It appears to be nearly allied to the Bucholzite.

OPAL. HYDROUS SILICA.

Opal, *Phil., &c.* ; Opale, *Beud., &c.* ; Uncleavable Quartz, *M.*

H.=5·5—6·5 ; Sp. gr. 1·9—3·5 ; of all colours ; Sk.† white ; Fr. conchoidal ; no cleavage.

Infusible alone, but becoming white and opaque before the blow-pipe. Giving off water in the matrass. Fusible, with soda (with brisk effervescence) into a clear glass.

C. P. Of the purest varieties—	<i>Buch.</i>	<i>Beud.</i>	<i>Klapr.</i>
Silica . . .	92·00 .	91·32 .	90
Water . . .	6·33 .	8·68 .	10

Varieties.

NOBLE OPAL. Precious Opal.

(Quartz resinite opaline.)

H.=about 6·5 ; Sp. gr. about 2·0 or 2·1 ; C. white or yellowish, with beautiful reflections of red, blue, green, and yellow ; T. 2, 4 ; L. vitreous. It occurs in trap and porphyry rocks in Hungary, Saxony, Auvergne, the Faroe Isles, and Honduras in America.

FIRE-OPAL.

(Quartz resinite girasol.)

This is merely a precious Opal, reflecting only red and yellow tints, from Zimapan in Mexico, Hungary, &c.

Note.—Some of the above varieties, which are white and nearly opaque, but possess the property of becoming transparent and reflecting the play of colours, when immersed in water, have obtained the names of Oculus Mundi, Hydrophane, &c.

HYALITE.

(Muller's glass ; Quartz hyalin concretionné.)

White ; vitreous ; transparent ; in small mamillated masses, or stalactites, in trap rocks at Walsch in Bohemia, Hungary, &c.

SILICEOUS SINTER. Fiorite.

(Pearl-sinter ; Kieselsinter.)

White, yellowish, grey ; translucent on the edges ; in stalactitic, mamillated, and other shapes, in the vicinity of hot springs, as in Iceland ; and in tufa, &c., in the volcanic districts of Italy.

COMMON OPAL, AND SEMI-OPAL (Halb-Opal).

C. white, grey, greenish, yellow, brown, &c., in different shades ; translucent or nearly opaque, with a weakly-shining resino-vitreous lustre, in trap rocks, in Hungary, Silesia, Bohemia, Iceland, &c.

* The original describer and namer of this mineral.

† In the impure ferruginous var. the Sk. is yellowish-brown.

WOOD-OPAL.

(Holz-Opal; Quartz resinite Xyloide.)

C. Yellow, grey, brown, &c., often in stripes or patches, and presenting a ligneous appearance. It occurs in Hungary, Van Diemen's Land, and other places.

MENILITE-OPAL.

In flat reniform masses of a slaty texture, and light or dark-brown colour, occurring in adhesive slate at Menil-montant, St Ouen, &c., near Paris. It is the Leber-opal of Werner.

FERRUGINOUS OPAL.

(Eisenopal, Jasper-Opal.)

Of a dark-red, brown, or yellow colour; opaque; Sk. yellowish-brown; Sp. gr. 3.0—3.5. It occurs in Hungary, &c., and contains from 40 to 50 per cent. of protoxide of iron.

Note.—The manganese opal (mangan-opal) from Siegen; is fusible before the blow-pipe, and agrees in every respect with the Opsimose or Hydrous Silicate of Manganese, which see.

CHRY SOLITE.

H.=6.5—7.0; Sp. gr. 3.3—3.5; yellow, green, brown; Sk. white.

P. F. a right rectangular prism.

Infusible alone.

See Sec. 2, B, of this Division.

CASSITERITE. OXIDE OF TIN.

H.=6.0—7.0; Sp. gr. 6.3—7.0; Sk. white, rarely pale-brown; L. resino-adamantine.

Infusible *per se*, but easily reducible with soda on charcoal.

See Sec. 2, B, of this Division.

Appendix to the Group.

HUMITE.

H.=6.5—7.0; in small yellow or reddish-brown crystals, of which the P. F. is considered to be a right rhombic prism of 60° and 120°. It occurs on Monte Somma, with mica, &c., and was first described and named by the Count de Bournon.

Group III.

CASSITERITE. See above.

AIMANTINE. MAGNETIC IRON OXIDE.

H.=5.5—6.5; Sp. gr. 4.8—5.2; Sk. black; L. semi-metallic or metallic; magnetic.

See Part II, Div. II, Sec. 2, B.

FRANKLINITE.

H.=6.0—6.5; Sp. gr. 5.0—5.1; Sk. reddish-brown; L. semi-metallic or metallic.

See Part II, Div. II, Sec. 2, B.

CHROMOFERITE. CHROMATE OF IRON.

H.=5.5; Sp. gr. 4.3—4.6; Sk. brown; L. semi-, or imperfect, metallic.

See Part II, Div. II, Sec. 2, B.

URANATEMNITE.

(Pitchblende.)

H.=5.5; Sp. gr. 6.4—6.6; Sk. black; no cleavage; L. imperfect metallic.

See Part II, Div. II, Sec. 3, B.

FERRUGINOUS VAR. OF OPAL.

H. about 5.5; Sp. gr. 3.0—3.5; Sk. yellowish-brown.

See Opal in the preceding Group.

SECTION 2.**A.**

The minerals of this Sub-section are too few in number to require to be farther subdivided.

PREHNITE.

H.=6.0—7.0; Sp. gr. 2.8—3.0; Sk. white; C. green white. P. F. a right rhombic prism.

Fusible, with continued bubbling, into a very blebby glass.

See Sec. 1, A (Gr. 1), of this Division.

SPODUMENE.

H.=6.5—7.0; Sp. gr. 3.0—3.1; Sk. white; C. light-green, greenish-white. It does not occur crystallized. Cleavage form, a rhombic prism.

Exfoliates into fibres before the blow-pipe, each fibre fusing easily into a nearly clear glass, and the point of the R. F. taking at the same time a purplish-red tint.

See Sec. 1, A (Gr. 3), of this Division.

EPIDOTE, OR THALLITE.

H.=6.0—7.0; Sp. gr. 3.2—3.5; Sk. greyish-white; C. green, brown, grey (Zoisite). P. F. a right oblique-angle prism of about 115° 30' and 64° 30'.

Curls up before the blow-pipe into a dark ramified mass with rounded edges.

See Sec. 1, A (Gr. 3), of this Division.

AXINITE.

H.=6.5—7.0; Sp. gr. 3.0—3.3; Sk. white; C. clove-brown, violet, green; L. vitreous. Occurring massive, but more generally in groups of sharp-edged flat (rhomboidal) crystals.

Easily fusible, with great bubbling, into a dark glass.

See Sec. 1, A (Gr. 3), of this Division.

GADOLINITE.

H.=6.5—7.0; Sp. gr. 4.2—4.3; Sk. grey; C. black; L. vitreous.

It occurs in small imbedded masses, and imperfect oblique rhombic prisms, which slightly attract the magnet.

Fusible, with intumescence, into an opaque yellowish globule.

See Sec. 1, A (Gr. 2), of this Division.

TAUTOLITE.

H.=6·5—7·0; Sp. gr. 3·865; Sk. greyish-white; C. black.

Fusible into a magnetic scoria.

See Sec. 1, A (Appendix), of this Division.

BORACITE. BORATE OF MAGNESIA.

Boracite, *Beud., Phil., &c.*; Tetrahedral Boracite, *M.*; Wurfelstein, *W.*

H.=7·0; Sp. gr. 2·8—3·0 (2·56, Westrumb, *Beud.*); C. greyish-white; Sk. white; L. adamantine-vitreous. It occurs only crystallized (fig. 21, 27, 28). P. F. the cube.

Fusible, with bubbling, into a white glass, which becomes opaque on cooling, and bristled over with minute crystals. During fusion it colours the flame greenish. It is also rendered electric by heat.

C. P. Boracic acid, 69·7, magnesia 30·3, *Arfwedson*.

P. L. Near Luneberg in Brunswick, and Segeberg, near Kiel, in Holstein, in small isolated crystals imbedded in gypsum, or in anhydrite.

Note.—The P. F. of this substance is considered by *Beudant* to be a rhombohedron, differing but slightly in its angles from the cube, and there are several circumstances, such as its possessing double refraction, &c., to make this extremely probable.

PORCELLANITE.

Porcelain Jasper.

H. about 7·0; Sp. gr. 2·5; C. grey, bluish, light-brown, reddish; Sk. white; opaque. It occurs in compact masses, without any cleavage planes.

Fusible into a white glass.

C. P. Silica 60·75, alumina 27·25, magnesia 3·00, potassa 3·66, oxide of iron 2·5, *Rose (?)*.

P. L. Carlsbad and Toplitz in Bohemia; Dudley (?) in Warwickshire, &c., in the vicinity of coal-seams which have undergone a partial combustion.

It is generally regarded, and with all probability, as clay or shale altered by heat.

TOURMALINE.

Id. Beud., Phil., &c.; Rhombohedral Tourmaline, *M.*; Schorl; Rubellite; Apyrite; Indicolite, &c.

H.=7·0—7·5; Sp. gr. 3·0—3·2 (3·0—3·42, *Beud.*); C. black, (Schorl), dark-green, light-green, brown, yellow, colourless (rare), blue (Indicolite), red (Rubellite, Siberite, &c.),* two or more of these colours being sometimes met with in the same crystal; Sk. white; L. vitreous; T. 0 or 3, 4,—the dark-coloured crystals being generally translucent when viewed at right angles to the axis of the prism, and opaque when examined parallel to it; other crystals are translucent or semi-transparent in all directions, and the black varieties (Schorl) are entirely opaque, except occasionally, when in thin splinters. It is easily rendered electric by heat, and occurs massive, in prismatic concretions, and in three, six, or nine-sided prisms, longitudinally striated (fig. 101, 104, 111, and 120). P. F. an obtuse rhomboid of 133° 50' and 46° 10'.

* There are varieties of this latter colour (red¹), which also belong to the Tourmaline (properly so called), as well as to the Rubellite.

Before the blow-pipe it intumesces more or less, and then fuses with difficulty (often only on the edges) into a black or yellowish glass or enamel. The red and blue varieties (Rubellite and Indicolite) also intumesce into a rounded mass, but resist further fusion. With soda on the platina wire, nearly all the varieties give the reaction of manganese,* the Rubellite doing so in a high degree.

C. P.	(1)	(2)	(3)	(4)
Silica . . .	37.81	39.16	39.37	40.30
Alumina . . .	21.61	40.00	44.00	40.50
Potassa . . .	1.20	3.59	1.29	4.30
Lithia . . .			2.52	
Lime . . .	0.98			
Magnesia . . .	5.99			
Ox. of manganese . . .	1.11	2.14	5.02	1.50
Magnetic ox. of iron . . .	7.77	5.96		4.05
Boracic acid . . .	4.18	4.59	4.18	1.10
Loss . . .		1.58	1.58	3.60

(1) Black Tourmaline, from St Gothard, by *Gmelin*.

(2) Green Tourmaline, from Brazil, by the same.

(3) Red Tourmaline, from Siberia, by the same.

(4) Blue Tourmaline from Sweden, by *Arfvedson*.

P. L. St Gothard (black, and of a light-green colour, in dolomite); the Tyrol; Norway; Sweden (black, red, and also of a blue colour, the Indicolite, at the Island of Uton); Bavaria; Saxony; Greenland; Scotland; Devonshire (in red feldspar, with apatite); Cornwall; Elba; Brazil; Siberia (in lithomarge); Moravia (at Rozena, with lepidolite mica); Massachusetts, U. S., &c., in granite, gneiss, mica-schist, and other primitive rocks. The three latter localities refer particularly to the Rubellite, but other varieties also occur there.

GARNET.

The various mineral substances usually classed together under this name, differ considerably in regard to their constituent parts.

By Beudant they are arranged as four distinct species, and this arrangement (with the exception of forming a fifth species of the Pyrope, which was classed by him with the Almandine) I have followed in the present place.

(1) FERRUGINO-ALUMINOUS GARNET.

Almandine of *Beudant*.

H.=7.0—7.5; Sp. gr. 3.9—4.24; C. red, with a dark-blue or yellowish shade, also brown, green, black. Sk. white; L. resinovitreous. It occurs massive, and crystallized (fig. 28 to 35).

P. F. the rhombic dodecahedron.

Fusible, sometimes with bubbling, into a dark globule, which acts upon the magnet.

C. P.	(1)	(2)
Silica . . .	33.75	39.66
Alumina . . .	27.25	19.66
Protoxide of iron . . .	36.00	39.68
Protoxide of manganese . . .	0.25	1.80

(1) From Bohemia, by *Klapr*.

(2) From Fahlun, by *Hisinger*.

* See Chapter I.

Varieties and P. L.

(A) PRECIOUS GARNET, OR ALMANDINE.

(C. bright shades of red, more or less translucent), from Ceylon, Greenland, Piedmont, Bohemia, &c., in the sands of rivers, or in primitive rocks.

(B) COMMON GARNET.

(C. dark-green, red, brown, nearly or quite opaque), from Fahlun in Sweden, and Arendal, &c., in Norway, in metalliferous veins; also from Zillerthal in the Tyrol, Bohemia, the Bannat, Saxony, Scotland, &c., in primitive rocks; and from Vesuvius, where it occurs with mica, idocrase, and other minerals in the ejected matters.

(2) CALCAREO-ALUMINOUS GARNET.

Grossulaire of *Beudant*.

H.=7.0—7.5 (more rarely 6.5 ?); Sp. gr. 3.35—3.73 (Beud.); C. green, yellow, yellowish-red, brown; Sk. white. It occurs massive in granular concretions, and crystallized (fig. 28 to 35); P. F. the rhombic dodecahedron.

Fusible, sometimes with bubbling, into generally a yellowish glass, which very rarely affects the magnet.

C. P.	(1)	(2)	(3)	(4)
Silica	40.55	37.0	41.21	40.00
Alumina	20.10	13.5	24.08	22.99
Lime	34.85	29.0	24.76	30.57
Oxide of iron	5.00	7.5	7.02	3.66
Oxide of mang.	0.48	4.7	0.92	
Magnesia		6.5		
Oxide of titanium		0.5		
Water		1.0		

(1) Grossular from Wiloui, by *Wachtmeister*.

(2) Colophonite from Arendal, by *Simon*.

(3) Romanzovite from Finland, by *Nordenskiöld*.

(4) Essonite from Ceylon, by *Gmelin*.

Varieties and P. L.

(A) GROSSULAR.

(C. light olive-green, transparent), from the banks of the Wiloui in Siberia, where it occurs with the variety of Idocrase, termed Wilouite.

(B) COLOPHONITE.

(C. yellow, orange-red, brownish, greenish, in granular concretions), imbedded in calc-spar at Arendal in Norway, and from North America, with Wollastonite.

(C) ESSONITE, OR CINNAMON STONE.

(C. red, with a yellowish or brownish tinge, massive, in granular concretions), from Ceylon, Brazil, and Malsjo, in Finland.

(D) ROMANZOVITE.

(C. brown, brownish-black, H. about 6.5, L. resino-vitreous, massive), from Kimito in Finland.

(3) CHROME GARNET.

Pyrope of Authors.

H.=7.0 (?)—7.5; Sp. gr. 3.7—3.8; C. blood-red, often very dark; Sk. white; semi-transparent. It occurs only in small round or angular masses.

Fusible, with bubbling, into a dark globule, which acts upon the magnet.

C. P. Silica 43·70, alumina 22·40, magnesia 5·60, protoxide of iron 11·48, protoxide of manganese 3·68, chromic acid 7·68, lime 6·72, *Wachtmeister*.*

P. L. Meronitz, &c., in Bohemia, in wacke and trap tufa; Zoebnitz in Saxony, in serpentine; Ceylon, in the sands of rivers, with Spinel, &c.

(4) FERRUGINO-CALCAREOUS GARNET.

Melanite of *Beudant*.

H.=6·5, more rarely 7·0 or 7·5; Sp. gr. 3·55—3·96 (Beud); C. black, brown, greenish-black, yellow; Sk. greyish-white. It occurs massive and crystallized (fig. 28 to 35). P. F. the rhombic dodecahedron.

Fusible, sometimes with bubbling, into a dark and generally magnetic globule.

C. P.	(1)	(2)	(3)	(4)	(5)
Silica	35·50	37·00	35·64	37	36·73
Lime	32·50	30·00	29·22	29	21·79
Peroxide of iron	25·25	18·25	30·00	25	25·83
Alumina	6·00	5·00		2	2·78
Protoxide of manganese	0·40	6·25	3·01	2	
Potassa			2·35		
Glucina				4	
Magnesia					12·44

(1) Melanite, from Frescati, by *Vauquelin*.

(2) Allochroite, by *Rose*.

(3) Aplome, by *Wachtmeister*.

(4) Topazolite, by *Bonvoisin*.

(5) A Green Garnet, from Sahla, by *Bredberg*.†

Varieties and P. L.

(A) MELANITE.

(C. black, opaque), from Frescati, near Rome, Vesuvius, &c., in ancient lava.

(B) ALLOCHROITE.

(C. greyish or yellowish-red, brown, in imbedded compact masses), from the iron mines near Drammen, in Norway.

(C) APLOME.

(C. deep-reddish or yellowish-brown, in crystals, the planes of which are striated parallel with their lesser diagonals; H. about 7·5), from Oravitza, &c., in the Bannat, Saxony, Siberia, and other places.

(D) TOPAZOLITE.

(C. yellow, in small transparent crystals), from Mussa and other places in Piedmont; often with the var. of Augite, named Mussite (Diopside).

(E) PYRENEITE (?)

(C. greyish-black, opaque, in minute crystals), from near Barèges in the Pyrenees, in primitive limestone.

* See Dr Thomson's 'System of Chemistry,' Part III, Vol. 1, p. 268 (seventh edition).

† See 'Beudant's Min.' t. 11, p. 51. The Topazolite is there arranged with the Grossulaire, but from its composition it evidently belongs to the present species.

There are, no doubt, many other varieties of this species arranged in cabinets, with those of the preceding species, under the vague and indefinite term of Common Garnet.

(5) MANGANESIAN GARNET.

Spessartine of *Beudant*.

H.=6·5, more rarely 7·0 or 7·5 ; Sp. gr. 3·6—4·1 (3·829 Thomson); C. dark reddish-brown; Sk. greyish-white; L. resino-vitreous, but weak. It occurs massive and crystallized. P. F. the rhombic dodecahedron.

Fusible alone, and giving with soda, in an intense degree, the reaction of manganese.*

C. P. Silica 35·83, alumina 18·06, protoxide of manganese 30·96, protoxide of iron 14·93, water 0·66, *Seybert*.

P. L. Finbo and Broddbo, near Fahlun, in Sweden; also in Franconia, North America, &c., in granite and other primitive rocks.

EUCLASE.

Id. Beud., Phil., &c.; Prismatic Emerald, *M.*

H.=7·5; Sp. gr. 3·06—3·1; C. white, pale-green, pale bluish-green; Sk. white; L. vitreous; easily frangible; becoming electric by friction. It occurs in crystals (fig. 221 *a*). P. F. a right oblique-angled prism of 130° 52', according to *Phillips*.†

Before the blow-pipe it becomes opaque, and fuses, if the blast be well kept up, into a white enamel.

C. P. Silica 43·22, alumina 30·56, glucina 21·78, oxide of tin 0·70, oxide of iron 2·22, *Berz.*

P. L. Peru, from whence it was first brought by the unfortunate French traveller and botanist, Dombey. Also, Capao, in the Brazils, in Chlorite-slate. It is a rare mineral.

EMERALD (INCLUDING BERYL).

Id. Phil.; Emeraude, *Beud.*; Rhombohedral Emerald, *M.*; Aquamarine, Aiguemarine, Smaragd.

H.=7·5—8·0; Sp. gr. 2·6—2·8; C. pure deep-green (Emerald), pale-green, greenish-yellow, greenish-blue, white (Beryl); L. vitreous. It occurs in prismatic concretions, and crystallized (fig. 93, 96, 98, 99, 100, 108, &c.), the crystals being generally longitudinally striated. P. F. the regular hexahedral prism.

Before the blow-pipe it soon loses its transparency and becomes of a pearly aspect, and ultimately fuses into a blebby glass, but it requires a strong heat to effect this.

C. P.	(1)	(2)
Silica	68·50 . . .	68·35
Alumina	15·75 . . .	17·60
Glucina	12·50 . . .	13·13
Oxide of chromium	0·30 . . .	
Oxide of iron	1·00 . . .	0·72
Lime	0·25 . . .	

(1) Emerald, from Peru, by *Klapr.*

(2) Beryl, from Broddbo, by *Berz.*

* I have never yet met with any variety of Garnet that did not give with soda, in a greater or less degree, the reaction of this metal, but generally only in the O. F., and never powerfully enough as to be mistaken for the present species.

† To perceive this, without cleaving the crystals, they must be held horizontally, that is to say, from right to left, in the direction of their greatest length, the *apparent* terminal planes forming lateral ones.

P. L. Emerald.—Peru; Granada, in Spain; Mount Zalora, in Upper Egypt; the Valley of Heubach, Saltzburg, &c., in primitive rocks. At the latter locality it is imbedded in chlorite-slate, and its colour is rarely very fine, the matrix being often mixed up with the crystals so as to render them nearly or quite opaque. **Beryl.**—Siberia; Sweden; Acworth, in New Hampshire, N. A.; Aberdeenshire; the Mourne Mountains, Ireland; Bavaria; Limoges, in France (a coarse variety in prismatic concretions), &c., in granite and other primitive rocks. Also Brazil, &c., in the sands of rivers. The crystals are generally longer in regard to their size than those of the Emerald; they are frequently very large.

IOLITE, OR DICHOITE.

Id. Phil.; Cordierite, *Beud.*; Prismatic Quartz, *M.*; Peliom; Steinheilite; Hard Fahlunite.

H.=7.0—7.5; Sp. gr. 2.5—2.6; C. blue, blackish-blue, but when viewed in certain directions (at right angles to the axis), brownish-yellow; Sk. white; L. vitreous. It occurs massive, and also occasionally crystallized (fig. 98, 106). P. F. the regular hexahedral prism.

Difficultly fusible (only on the edges, unless it be in a very thin splinter) into a pale-bluish glass.

C. P. Silica 49.95, alumina 32.88, magnesia 10.45, protoxide of iron 5.00, protoxide of manganese 0.03, loss 1.75, *Bonsd.*

P. L. Bodenmais in Bavaria, with magnetic pyrites; Orijevri in Finland, and Fahlun in Sweden, with copper pyrites, &c.; Simitok in Greenland, with quartz; Cape de Gatte in Spain; in granite, mica-schist, &c.

SECTION 2.

B.

Remarks.—The minerals of this Sub-section, although easily distinguishable one from another, yet do not present any general, and at the same time *simple*, features common to several, by which they may be farther subdivided. I have, however, arranged them for the sake of easy reference in the two following groups:

Group 1. Comprising those substances whose hardness does not exceed that of Quartz; and

Group 2. Comprising those which scratch Quartz with facility.

In regard to the few minerals whose hardness varies from 7.0 to 7.5, I have placed them at the end of the first group, as they form the connecting link between the two.

Group 1.

KYANITE, OR CYANITE.

H.=5.0—7.0; Sp. gr. 3.5—3.7; C. blue, white, reddish; Sk. white; L. pearly-vitreous. It occurs in bladed and diverging fibrous concretions, also crystallized (fig. 241 and 243). P. F. a double-oblique prism of $106^{\circ} 15'$, and $73^{\circ} 45'$.

Perfectly infusible *per se*.

See Div. II, Sec. 7, A (Gr. 2).

THALLITE, OR EPIDOTE.

H.=6·0—7·0; Sp. gr. 3·2—3·5; C. green, brown, grey (Zoizite); Sk. greyish-white. P. F. a right oblique-angled prism of about 115° 30' and 64° 30'.

Before the blow-pipe it curls up into a dark ramified mass, which cannot be brought into a clean globule.

See Sec. 1, A (Gr. 3), of this Division.

IOLITE.

C. blue, brownish by transmitted light in certain directions.

Difficultly fusible.

See A, of this Section.

RUBELLITE. } INDICOLITE. } VAR. OF TOURMALINE.

C. red, blue. In three or six-sided prisms, often aggregated.

Intumescing before the blow-pipe into a rounded mass, which resists farther fusion.

See A, of this Section.

CASSITERITE. OXIDE OF TIN.

Id. Beud., (χαρσιτερος, tin); Stannolite, *Neck.*; Oxide of Tin, *Phil.*; Pyramidal Tin Ore, *M.*

H.=6·0—7·0; Sp. gr. 6·3—7·0; C. brown, grey, white, black, reddish, yellowish; Sk. white, occasionally pale-brown in the dark varieties; L. resino-adamantine. It occurs massive, reniform, globular, in rolled pebbles (stream tin), in fibrous concretions, &c. (wood tin), and crystallized (fig. 45, 46, 48, 51, 54, 54a, 60?)* P. F. an obtuse octahedron, with square base.

Note.—In Cornwall, pseudomorphic crystals of Cassiterite occur in the form of the flat twin Feldspar crystals.

Before the blow-pipe in the forceps it is infusible, but it may be reduced on charcoal *per se* in a well-sustained blast. With soda, on this substance, it is instantly reduced.

C. P. Oxygen 21·33, tin 78·67, if perfectly pure; but it usually contains minute portions of the oxides of iron, manganese, and tantalum.†

P. L. Cornwall, in veins in granite and clay-slate, &c., also in the alluvial "stream-works." Bohemia, Saxony, France, Spain, Malacca, &c., in smaller quantities, in granite, gneiss, and other primary rocks, as well as in alluvial deposits, resembling those of Cornwall.

GISMONDINE.

Id. Phil., Beud.; Zeagonite; Abrazite.

H.=7·0—7·5; Sp. gr. 2·16—2·2; C. white; Sk. white; L. vitreous.

It occurs in crystals (fig. 186 a), and also in aggregated granular concretions. P. F. a right square prism.

* It also occurs in maced crystals, delineations of which may be seen in 'Phillips's Mineralogy,' &c.

† A black variety from Finbo yielded to Berzelius as much as 2·4 per cent. of this latter substance.

Infusible *per se*. Forms a gelatinous mass in heated acids.

C. P. Silica 41·4, lime 48·6, alumina 2·5, magnesia 1·5, oxide of iron 2·5, *Carpi*.

P. L. Capo di Bove, near Rome, in lava, with nepheline, &c.

QUARTZ. SILICIC ACID OR SILICA.

Quartz, &c., *Phil.*; Quarz, *Beud.*; Rhombohedral Quartz, *M.*

H.=7·0; Sp. gr. 2·6—2·7; Sk. white. P. F. a rhomboid of 94° 15' and 85° 45'.

Infusible alone. Easily fusible with soda, with great effervescence, into a clear glass.

C. P. Oxygen 51·95, silicium 48·05, if perfectly pure.

Varieties and P. L.

The numerous varieties of this substance may be conveniently described under three heads:—

- (A) *Hyaline Quartz*;
- (B) *Calcedonic Quartz*; and
- (C) *Jasper Quartz*;

The latter being more or less mixed with oxide of iron.

(A) *Hyaline Quartz*.

(1) ROCK-CRYSTAL AND COMMON QUARTZ.

C. white, pink, yellow, brown (*smoky quartz*), black, blue (*siderite*), &c., transparent, translucent; massive, and crystallized (fig. 65 (rare), 134, 135, 136, 137).

It occurs in all primary countries. Very fine crystals are brought from the Brazils, St Gothard, Dauphiny, &c., often containing crystals of rutile, schorl, asbestos, and other minerals. The yellow and brown coloured varieties occur in Inverness-shire, and other parts, and the blue quartz, or *siderite*, comes from Salzburg.

(2) ROSE QUARTZ AND MILK QUARTZ.

C. rose-red, often very pale or white, and of a milky aspect; massive.

P. L. Rabenstein in Bavaria, Finland, Connecticut, U. S.

(3) AMETHYST AND VIOLET QUARTZ.

C. violet, deep or pale, also sometimes greenish; massive, and in aggregated pyramidal crystals, presenting in the fracture undulating or zig-zag structural lines.

P. L. India, Siberia, Transylvania, Bohemia, Ireland, &c.

(4) PRASE.

C. dark-green; massive, mixed with actynolite, &c.

L. Breitenbrunn in Saxony.

(5) HORNSTONE, FLINT, LYDIAN-STONE.

C. grey, reddish, yellowish, black (*Lydian-stone*, or *Basanite*); massive, sometimes forming pseudomorphic crystals, and the petrifying substance of organic remains. Fr. conchoidal, splintery.

P. L. Saxony, Hungary, the Tyrol, Cyprus, Bohemia (*Hornstone*, *Flinty-slate*, *Lydian-stone*). Also in the chalk strata of England, France, &c. (*Flint*).

(6) FLOATSTONE.

C. white, grey; in congeries of minute crystals, having in the mass a spongi-

form appearance. It floats for some time in water, owing to the air which is contained in its cavities.

P. L. Menil Montaut, near Paris; Cornwall.

(B) *Calcedonic Quartz.*

(1) CALCEDONY. CARNELIAN.

C. grey, white, blue, yellow, red (*carnelian*); no cleavage; in stalactitic and mamillated shapes, also in pebbles, and pseudo-morphic crystals.

Note.—When the above colours occur in veins or layers, &c., the numerous varieties of Agate and Onyx are formed, of which the following have been principally distinguished:—Landscape Agate; Riband Agate; Fortification Agate, the colours running in zig-zag lines; Spotted Agate, or St Stephen's Stone, a white calcedony, with disseminated spots of red jasper, formerly held in high estimation as the blood of St Stephen; Moss Agate, containing small dendritic markings, which are, in some cases, considered to be portions of cryptogamic plants. The Onyx consists of parallel layers of calcedony of different colours, and is used chiefly in the formation of cameos.

(2) CHRYSOPRASE.

C. Apple-green; massive; translucent, with feeble lustre. It contains, according to Klaproth, 1.0 per cent. of oxide of nickel, to which its colour is attributed.

P. L. Kosemutz and Frankenstein in Silesia. Also, Vermont, N. A.

(3) PLASMA.

C. Grass-green; semi-transparent; L. slightly waxy; massive.

P. L. India, China. A greenish calcedony, generally surrounded by a white earthy crust, and which has been referred to this variety, occurs also in Baden.

(4) HELIOTROPE.

C. Dark-green, often with spots of red jasper (*bloodstone*); massive. It is a mixture of calcedony and green-earth, or chlorite.

P. L. Bucharia, Siberia, Isle of Rum, &c.

(5) CAT'S-EYE.

C. White, grey, yellowish, brown, greenish, &c.; massive, of a delicately fibrous structure, presenting (particularly when cut *en cabochon*) a chatoyant play of light.*

P. L. Ceylon.

(C) *Jasper Quartz.*

(1) STRIPED OR RIBAND JASPER.

C. Green, grey, yellow, brownish, &c.; in parallel layers; massive; opaque, with feeble or no lustre.

P. L. Siberia; Gmandstein, near Altenburg, in Saxony; Devonshire.

(2) COMMON JASPER.

C. Brown, red, green, &c.; massive; dull, or with very feeble lustre, and opaque, except when in splinters.

P. L. Cornwall; Scotland; Saxony, &c.

(3) EGYPTIAN JASPER.

C. Red, brown, black, &c., often lighter internally. It occurs in pebbles and roundish masses, and is in every respect identical with the preceding.

L. Egypt: the tract between Grand Cairo and the Red Sea; is cited as its particular locality.

* This is also often produced by minute threads of amianthus, imbedded in the mass.

(4) IRON FLINT.

C. Yellow, red, brown; massive, or in aggregated crystals (fig. 134). It is quartz mechanically mixed with oxide of iron, and referrible as such to the present division or variety.

P. L. Schellerhau, &c., in Saxony; Bohemia; Iserlohn in Westphalia, and other places.

Note.—The reader is referred for a more detailed account of the different varieties and sub-varieties of Quartz, to 'Phillips's Mineralogy,' and other works, particularly the Manual of Mr Allan.

NEPHRITE, OR JADE.

Nephrite, *Phil.*, *Beud.*, &c.; Uncleavable Nephrite Spar, *Haid.*

H.=7·0; Sp. gr. 2·9—3·1; C. green, greyish-green, greenish-white; Sk. white; T. 1; L. vitreo-resinous. It occurs massive, possessing a compact texture; Fr. splintery.

Infusible *per se* (?).

C. P. Silica 50·50, alumina 10·00, magnesia 31·00, oxide of iron 5·50, oxide of chromium 0·05, water 2·75, *Kastner*.

P. L. China, Egypt, Corsica, &c., in primitive rocks.

CHRYSLITE (INCLUDING OLIVINE).

Id. Phil.; Peridot, *Beud.*; Prismatic Chrysolite, *M.*; Olivine; Hyalosiderite.

H.=6·5—7·0; Sp. gr. 3·3—3·5; C. yellowish-green, yellow, green, brown; Sk. white; L. vitreous. It occurs in granular concretions, and crystallized (fig. 162, 163). P. F. a right rectangular prism.

Infusible *per se*.

C. P. Silica 41·42, magnesia 49·61, protoxide of iron 9·14,* protoxide of manganese 0·15, alumina 0·15, from Bohemia, *Walmstedt*.

P. L. Auvergne in France; Vivarais, and Bonn on the Rhine; Snarum in Norway; Bohemia; Groditzberg in Silesia; Hessia, &c., in greenstone, basalt, and other trap rocks. Also, the vicinity of Vesuvius, in lava.

The Chrysolite of commerce is chiefly collected in the Levant, but its localities are unknown.

STAUROLITE.

Id. Phil.; Staurotide, *Beud.*; Prismatoidal Garnet, *M.*; Grenatite; Croisette.

H.=7·0—7·5; Sp. gr. 3·2—3·9; C. dark reddish-brown, brown; Sk. white; L. resino-vitreous; translucent or opaque. It occurs only crystallized, the crystals being often macled in the form of a cross (fig. 152, 169, 258, 258 a, 259). P. F. a right rhombic prism of 129° 20', and 50° 40'.

Infusible *per se*, imparting to borax the tints of iron, and to soda on the platina wire, those of manganese.

C. P. Silica 33, alumina 44, oxide of iron 13, oxide of manganese 1, lime 3·84, *Vaug.*

P. L. St Gothard, in mica and talc-schist, with crystals of kyanite; the Tyrol; Brétagne, in micaceous clay (macled crystals); Compostella in Spain (macled crystals,) &c.

FIBROLITE.

Id. Beud., *Phil.*, &c.

H.=7·0—7·5; Sp. gr. 3·214 (Bournon); C. grey, white; Sk. white; In. L. pearly-vitreous. It occurs massive, possessing a

* This ingredient in some varieties is as high as 15·0, or more, per cent.

fibrous texture. P. F. (?) a right rhombic prism of 100° and 80° (Bournon).

Infusible *per se*.

C. P. Silica 38.00, alumina 58.25, oxide of iron 0.75, *Chenevix*.

P. L. China and the Carnatic, with corundum. It is also said to occur at Marschendorf in Moravia.

Group II.

EMERALD.

C. green, yellowish, or bluish-green. Crystallizing in six-sided prisms. Difficultly fusible.

See A of this Section.

ANDALUSITE.

Id. Beud., Phil.; Prismatic Andalusite, *M.*; Felspath Apyre; Stanzait; Hard-Spar; Micaphyllite.

H.=7.5; Sp. gr. 3.0—3.2; C. grey,* reddish-grey, purplish-red; Sk. white; T. 0, 1, 2; L. vitreous, but generally weak. It occurs massive, and crystallized, in four-sided slightly-rhombic prisms. P. F. a rhombic prism of $88^{\circ} 40'$ and $91^{\circ} 20'$.

Infusible *per se*, and very difficultly fusible with borax.

C. P. Silica 32, alumina 52, potassa 8, oxide of iron 2, loss 6, *Vauq.*

P. L. Andalusia in Spain; Braunsdorf in Saxony; Forez in France; the Tyrol; Moravia; Banffshire, Scotland; Killiney in Ireland; North America, &c., in primitive rocks.

Note.—At Inspruck in the Tyrol, a mineral substance (*Kyanite*, in all probability, as first stated by Möhs) occurs in large pseudo-morphic crystals, having the form and appearance of andalusite; but the hardness of these crystals does not exceed 5.0, and their Sp. gr. is about 3.54. I have placed this substance in Div. II, Sec. 7, A, under the name of Pseudo-Andalusite, not with the intention of forming a distinct species of it, as little doubt can exist but that it is referrible to the Kyanite, but merely to enable those who may never have seen it before, to discover easily its right nature by means of the present artificial arrangement.

ZIRCON.

Id. Beud., Phil.; Pyramidal Zircon, *M.*; Jargoon; Zirconite; Hyacinth.

H.=7.5; Sp. gr. 4.5—4.7; C. hyacinth-red, grey, light-brown, reddish-brown, yellow, white, greenish, bluish; Sk. white; T. 4 to 0; L. adamantine or resino-vitreous. It occurs in small rolled masses, and crystallized (fig. 47, 48, 50). P. F. an obtuse octahedron with square base, fig. 55, in which it occasionally occurs.

Infusible alone. With borax, fusing into a glass, which, when saturated, becomes opaque on cooling, or when *flamed*.

C. P. Silica 33.48, zirconia 67.16, from Expailly, *Berz.*

P. L. Ceylon; Transylvania; Auvergne; in the sands of rivers or brooks. Laachersee, near Bonn, on the Rhine; Vesuvius; in trachytic rocks, and volcanic tufa. Also, Norway; Sweden; Greenland, &c., in syenite; and Siberia; New Jersey, and other places; in primitive rocks.

* Generally pearl-grey, but sometimes dark blackish-grey, or almost black in the mass.

TOPAZ (INCLUDING PYCNITE).

Id. Phil.; Topaze, Picnite, *Beud.*; Prismatic Topaz, *M.*; Pyrophysalite.

H.=8·0; Sp. gr. 3·4—3·6; C. yellow, white, greenish, bluish, red, grey; Sk. white; L. vitreous; transparent, opaque. It occurs massive, in prismatic or bacillary concretions (*Pycnite*), also in coarse granular concretions, almost opaque (*Pyrophysalite**), and crystallized (fig. 163, 164, 181, 182, 184). P. F. a right rhombic prism of about $124^{\circ} 22'$ and $55^{\circ} 38'$.

It is easily rendered electric by heat or friction.

Infusible alone, but in a well-sustained blast, a few minute bubbles form and burst on the faces of crystallization.

C. P. Fluoride of aluminium 24·91, silicate of alumina 75·07, *Beud.*

P. L. Siberia, Saxony, Bohemia, Cornwall, Scotland, Ireland, &c., in primitive rocks. Also, the Brazils, Australia, &c., in alluvial soil, and the sands of rivers.

GAHNITE, OR AUTOMALITE.

Gahnite, *Beud.*; Automalite, *Phil.*; Octahedral Corundum, *M.*; Spinelle Zincifère.

H.=8·0; Sp. gr. 4·1—4·3; C. blackish-green, very dark; Sk. greyish-white; T. 0, or faintly 1; L. resino-vitreous. It occurs only crystallized, in octahedrons, which are frequently maced, and also in modified tetrahedrons. P. F. the regular octahedron.

Infusible alone. With soda it forms a dark scoria, which, if again fused with the same reagent, will deposit on the charcoal a white circle of oxide of zinc.

C. P. Alumina 60·00, oxide of zinc 24·25, oxide of iron 9·25, silica 4·75, with traces of lime, *Ekeberg*.

P. L. Fahlun, &c., in Sweden, in talc-schist; New Jersey, with quartz, &c., and Haddam, Connecticut, with tantalite, chrysoberyl, and other minerals.

SPINEL.

Id. Phil.; Spinelle, *Beud.*; Dodecahedral Corundum (in part), *M.*; Balas Ruby.

H.=8·0; Sp. gr. 3·5—3·76; C. red, yellowish-red, white, pale-bluish, grey; Sk. white; L. vitreous. It occurs in small imbedded masses (the bluish and grey Spinel from Sweden), but more commonly crystallized (fig. 8, 12, 13, 28, &c.), and often in macles (fig. 250, 251, 252). P. F. the regular octahedron.

Infusible *per se*.

C. P. Alumina 69·01, magnesia 26·21, silica 2·02, oxide of chromium 1·10, protoxide of iron 0·71, *Hermann Abich*.

P. L. Ceylon, &c., where it is found in the sands of rivers; also, Aker in Sudermannland, Sweden, in calc-spar in primitive rocks.

PLEONASTE, OR CEYLONITE.

Pleonaste, *Beud.*, *Phil.*; Dodecahedral Corundum (in part), *M.*; Ceylanite; Candite.

H.=8·0; Sp. gr. 3·575—3·8; C. black, dark blackish-green; Sk. greyish-white; opaque in the mass. It occurs massive (*Candite*), and crystallized (fig. 8 to 12, 15, 28 to 34). P. F. the regular octahedron.

Infusible *per se*. Fusing with borax into a glass strongly coloured by iron.

* This variety occurs also in very large and coarse crystals.

C. P. Alumina 57·20, magnesia 18·25, peroxide of iron 20·50, silica 3·15, *Gmelin*.

P. L. Ceylon; Monte Somma, Vesuvius, with idocrase, &c.; Laach on the Rhine, in trachytic debris; Monzoni, in the Tyrol, in compact Gehlenite. Also, Amity, Orange County, U. S., in large crystals, with condrodite, &c.

SECTION 3.

CHRYSOBERYL, or CYMOPHANE.

Chrysoberyl, *Phil.*, &c.; Cymophane, *Beud.*, &c.; Prismatic Corundum, *M.* H.=8·5; Sp. gr. 3·65—3·8; C. yellowish-green, greenish-white, often with a milk-white opalescence; Sk. white; L. resino-vitreous; T. 3, 4. It occurs in rolled pieces, and crystallized (fig. 203). P. F. a right rectangular prism.

Infusible *per se*.

C. P. Alumina 76·752, glucina 17·791, protoxide of iron 4·494, volatile matter 0·480, *Thomson*.

P. L. Brazil and Ceylon, in alluvial soil, and the sands of the rivers; Had-dam, Connecticut, in granite, with beryl, columbite, and other minerals.

CORUNDUM.

Id. Phil.; Corindon, *Beud.*; Rhombohedral Corundum, *M.*; Corundite; Te-lesie; Sapphire, &c.

H.=9·0; Sp. gr. 3·9—4·16; Sk. white; L. vitreous. P. F. a rhombohedron of 86° 4' and 90° 56'.

Infusible *per se*.

C. P. Of the purest varieties—oxygen 46·71, aluminium 53·29. It however generally contains small portions of oxide of iron and silica. (See below.)

Varieties and P. L.

SAPPHIRE.

C. blue, white, red (*Oriental Ruby*), yellow (*Oriental Topaz*), violet (*Oriental Amethyst*), green (*Oriental Emerald*); transparent or translucent; doubly refractive. It occurs in small rolled masses, and crystallized (fig. 72, rare, 94, 97, 98, 117, 118, 121, 122, 123, 124).

Note.—Some varieties, when cut, *en cabochon* at right angles to the axis, present an opalescent star of six rays, and are named *Asteria Sapphires*. Others are also termed by lapidaries, *Girasol* and *Chatoyant Sapphires*.

C. P. Of a blue sapphire—alumina 98·5, oxide of iron 1·0, lime 0·5, *Klapr*.

P. L. Ceylon; Pegu; Saxony; Bilin in Bohemia, &c., in the sands of rivers or brooks, and in primitive rocks.

COMMON CORUNDUM.

C. greenish, white, red, brown (*Adamantine Spar*), yellowish, &c.; T. 3, 0. It occurs massive, in rolled pieces, and crystallized as the above, from which it differs merely in being a coarser variety, unfit for the purposes of jewellery.

C. P. Alumina 89·50, oxide of iron 1·25, silica 5·50, from Bengal, *Klapr*.

P. L. China; the Carnatic; Malabar; Sweden, with aimantine; Piedmont, &c., in the beds of rivers, and in primitive rocks.

EMERY, or Granular Corundum.

C. black, greyish-black; Sk. greyish-white; opaque. It occurs massive; composition, fine granular.

C. P. Alumina 86, oxide of iron 4, silica 3, *Tennant*.

It often attracts the magnet, being mixed with oxide of iron.

P. L. The Island of Naxos; Smyrna; Schneeberg in Saxony, &c.

DIAMOND.

Diamant, *of the French*; Demant, *of the Germans*; Octahedral Diamond, *M.* H.=10; Sp. gr. 3·4—3·6; C. white, grey, yellowish, brownish, red, blue, green, black; Sk. white; L. adamantine, commonly semi-transparent, also transparent, translucent, and rarely opaque, the latter referring to the brownish and black varieties. It refracts singly, and occurs only in detached crystals, the planes of which are often, if not commonly, convex (fig. 8 to 13, 20 to 24 (very rare), 28; and with convex planes, 267 to 270). P. F. the regular octahedron.

Before the blow-pipe the surface is deprived of its polish, and a small splinter may be consumed, on charcoal, in a long-sustained blast.

C. P. Pure carbon.

P. L. Hindostan and Brazil, in the channels of rivers and streams, and in alluvial soil.

END OF PART I.

PART II.

DIVISION I.

SECTION 1.

NATIVE MERCURY.

Mercuré, *Beud.*; Native Quicksilver, *Phil.*, &c.

Fluid; Sp. gr. 12·0—15·0; C. tin-white; opaque; L. metallic.

Entirely volatilizable before the blow-pipe.

C. P. Pure mercury.

P. L. Idria in Carniola, and Almaden in Spain; also the Palatinate, Hungary, &c., chiefly in secondary rocks, such as the sandstones and shales of the carbonaceous series.

NATIVE AMALGAM. HYDRARGURET OF SILVER.

Native Amalgam, *Phil.*; Amalgame, *Beud.*

Occasionally semi-fluid, but more commonly solid; H.=1·0—3·5;

C. silver-white; brittle.

Partly volatilizable before the blow-pipe, a bead of silver remaining.

See Section 3.

SECTION 2.*

NATIVE GOLD.

Id. Phil.; Or, *Beud.*, &c.; Hexahedral Gold, *M.*; Electrum.

H.=2·5—3·0; Sp. gr. 12·5—19·5; C. yellow, greyish-yellow, and pale yellowish-white, inclining to silver-white (*electrum*). It occurs in grains and flakes, dentiform, capillary, in foliæ, &c., and crystallized (fig. 8 to 13, 20 to 24, 28, &c.). Structure, compact, uncleavable, but the cube is assumed as its primary form. Very ductile; L. metallic.

Easily fusible. Soluble only in a mixture of the nitric and hydrochloric (muriatic) acids; a purple precipitate being thrown down from the solution, on the addition of chloride of tin.

C. P.	(1)	(2)	(3)
Gold . . .	99·34 . . .	94·00 . . .	64
Silver . . .	0·14 . . .	5·85 . . .	36
Iron . . .	0·005 . . .	. . .	. . .
Copper . . .	0·43 . . .	. . .	. . .
Platina . . .	. . .	0·15 . . .	. . .

(1) From Siberia, by *Rose*.

(2) From Brazil, by *Darcet*.

(3) *Electrum*, by *Klaproth*.

P. L. Brazil, Mexico, Peru, in alluvial soil, in which it has likewise been found in the Wicklow Mountains, Ireland, at Lead-hills in Scotland, in the "stream-works" of Cornwall, and in various parts of the Continent. Also, Siberia, Hungary, Transylvania, Norway, Dauphiné in France, &c., in granite and syenite, as well as in gneiss, mica-slate, grauwacke, and other primitive and transition rocks.

* All the minerals of this Section possess a shining Sk., unchanged in colour.

NATIVE LEAD.

Id. Allan, &c., Plomb, Beud.

H.=1·5; Sp. gr. 11·0—12·0; C. lead-grey; ductile; amorphous; L. metallic.

Very easily fusible, covering the charcoal with the yellow oxide of lead. Soluble in nitric acid, and precipitated from the solution on a polished bar of zinc, but not on a bar of copper.

C. P. Pure lead.

P. L. The lavas of Vesuvius and Madeira.

NATIVE SILVER.

Id. Phil., &c.; Argent, Beud.; Hexahedral Silver, M.

H.=2·5—3·0; Sp. gr. 10·0—11·0; C. silver-white, often tarnished yellowish or greyish-black, also pale brass-yellow (*Auriferous Native Silver*); opaque; ductile; L. metallic. It occurs disseminated, in leaves, capillary, filiform, arborescent, &c., and crystallized (fig. 8 to 13, 20 to 33). Structure, compact, uncleavable, but the cube or the octahedron is assumed as the P. F.

Very easily fusible. Soluble in nitric acid, and precipitated from the solution on a polished bar of copper.

C. P. Either pure silver, or silver alloyed with small portions of copper, antimony, &c. The *Auriferous Silver* consists of silver 32·12, gold 76·41, *Rose*; but occasionally the silver predominates, as in the following analysis by *Fordyce*:—Silver 72, gold 28, from which it will be seen that this substance cannot properly be separated from *Electrum*.

P. L. Peru, Mexico, Hungary, Bohemia, Saxony (Freyberg, &c.), Dauphiné, the Hartz, Norway, Cornwall, in veins chiefly traversing granite, syenite, and primitive and transition rocks.

NATIVE BISMUTH.

Id. Phil.; Bismuth, Beud.

H.=2·0—2·5; Sp. gr. 9·6—9·8; C. silver-white, with a slightly reddish tinge. Sectile, almost malleable.

Easily fusible into a globule, which flattens under the hammer, but breaks at the same time.*

See Section 3.

NATIVE COPPER.

Id. Phil., &c.; Cuivre, Beud.; Octahedral Copper, M.

H.=2·5—3·0; Sp. gr. 8·4—8·9; C. red, brownish-red; ductile; L. metallic.

It occurs massive, ramose, dendritic, &c., and crystallized (fig. 8 to 13, 20 to 33). Structure, compact, uncleavable, but the cube or octahedron is adopted as the P. F.

Easily fusible.† Soluble in nitric acid, to which it imparts a green colour, and also in ammonia, the solution being coloured blue.

C. P. Pure copper, sometimes alloyed with minute portions of iron.

P. L. Cornwall, Siberia, Mexico, the Bannat, Chessey in France, Bingen on the Rhine, Hungary, &c., chiefly in granite and primitive and transition rocks. It also occurs in large "erratic" masses, in alluvial districts in North America.

* To try the malleability of the globules of reduced metal as obtained by the blow-pipe, a small anvil or flat polished piece of steel is requisite, upon which the globule is placed, being first folded in a piece of thin paper to prevent it from flying off when struck.

† For its reactions with the fluxes see *Oxide of Copper*, Chapter I.

TELLURET OF SILVER.

Telluric Silver, *Phil.*; Tellur-Silber, *Rose*.

H. about 2·5 (?); Sp. gr. 8·41—8·56; C. steel or lead-grey. Sec-tile, inclining to malleable.

Easily fusible.

See Sec. 3.

ARGYROSE. SULPHURET OF SILVER.

Argyrose, *Beud.*; Sulphuret of Silver, *Phil.*; Hexahedral Silver Glance, *M.*; Silver Glance; Vitreous Silver; Henkelite.

H.=2·0—2·5, if not in a decomposed or friable state; Sp. gr. 6·9—7·2; C. blackish lead-grey; opaque; perfectly malleable; L. metallic. It occurs massive, dentiform, capillary, reticulated, &c. and crystallized (fig. 25 chiefly, also 8, 9, 20, 28, &c.) P. F. the cube (the cleavage is parallel to the faces of a dodecahedron, but very imperfect). It also occurs in an earthy state.

Fusible, with considerable ebullition, into a bead of silver surrounded by a blackish scoria. During fusion it gives a sulphureous odour.

C. P. Sulphur 12·96, silver 87·05, *Berz.*

P. L. Mexico, Freyberg in Saxony, Joachimsthal in Bohemia, Cornwall, Hungary, Dauphiné, &c. chiefly in primitive rocks.

STERNBERGITE.

Sternbergite and Flexible Sulphuret of Silver, *Phil.*; Sternbergite, *Haid.*

H.=1·0—1·5; Sp. gr. 4·2—4·25; C. pinchbeck-brown, black; flexible in thin laminae, and malleable; opaque; L. metallic. It occurs massive, and in small tabular crystals generally grouped into rosettes. P. F. a rhombic octahedron of 118°, 84° 28', and 128° 49' (*Haid.*).

Alone before the blow-pipe it burns with a blue flame, emits powerful sulphureous vapours, and melts into a globule, which is generally hollow, has a crystalline surface, and is covered with metallic silver. This globule acts powerfully on the magnet, and communicates to fluxes the colours produced by iron. ('Allan's Manual,' p. 271.)

C. P. Sulphur 34·3, iron 32·8, silver 32·9, *Berz.*

P. L. Joachimsthal in Bohemia, and Freyberg in Saxony. It is a rare mineral.

SECTION 3.

Remarks.—The minerals of this Section are arranged in the four following groups:—

Group 1. Infusible before the blow-pipe.

Group 2. Fusible, and entirely volatilizable.

Group 3. Fusible, and partly volatilizable; the residue giving, with borax, the reactions of COPPER.*

* A green glass in the O. F., turning in the R. F. dark red and opaque. (See Chapter I.)

Group 4. Fusible, and partly volatilizable; the residue NOT giving with borax the reactions of COPPER.

Group I.

GRAPHITE.

Id. Beud.; Plumbago, *Phil.*; Rhombohedral Graphite Mica,* *M.*

H.=1.0—2.0; Sp. gr. 2.0—2.45; C. iron black, passing into steel-grey, and lead-grey; Sk. shining metallic; powder, black; opaque; soils and writes; flexible in thin laminae; sectile; unctuous to the touch; L. metallic. It occurs in foliated masses, in granular concretions, and rarely in flat six-sided tables.

Infusible, both alone and with the fluxes.

C. P. Carbon 90.9, iron 9.1, *Berthollet*.

P. L. Borrowdale, in Cumberland, in transition rocks; Ayrshire, Scotland, in the coal-strata; Inverness-shire, in gneiss; Arendal, in Norway; Finland; Austria; the United States, &c.

MOLYBDENITE.

Id. Beud.; Sulphuret of Molybdena, *Phil.*; Rhombohedral Molybdena Glance, *M.*; Wasserblei, *W.*

H.=1.0—1.5; Sp. gr. 4.4—4.7; C. lead-grey; Sk. black on paper, dark greenish on smooth porcelain; opaque; sectile; writes, soils slightly; flexible in thin laminae; unctuous to the touch; L. metallic. It occurs in plates and foliated masses, disseminated, and more rarely in imperfect six-sided tables.

Infusible before the blow-pipe, but loses its lustre and becomes brownish, emitting a sulphureous odour, and dissipating partly in white fumes. In soda it is dissolved with effervescence, forming a clear glass, which becomes opaque on cooling, and indicates, by its yellowish or reddish colour, the presence of sulphur. In microcosmic salt it dissolves slowly, forming a fine green glass. With nitre it deflagrates. In nitric acid it is converted into a white powder, which becomes blue when placed on a moistened bar of zinc.

C. P. Sulphur 40, molybdenum 60, *Bucholz*.

P. L. Norway, Sweden, Savoy, Piedmont, the Alps of Dauphiné, Cumberland, &c., in granite and primitive rocks. And also in metalliferous veins in Cornwall, Bohemia, Saxony, Arendal in Norway, &c.

PYROLUSITE.

Id. Beud., Phil.; Prismatic Manganese Ore, *M.*; Anhydrous Peroxide of Manganese, *Turner*.

H.=1.5—2.5; Sp. gr. 4.6—4.9; C. iron-black; Sk. black; opaque; soils; L. metallic. It occurs massive, reniform, in an earthy state, and in fibrous and divergent prismatic concretions. P. F. a right rhombic prism of 86° 20' and 93° 40'.

Infusible *per se*. Imparting to soda, on the platina wire, the deep-green colour indicative of manganese. Soluble in borax, with brisk effervescence.

* Transferred by Haidinger to the new order, *Terene*.

C. P. Peroxide of manganese 97·835, baryta 0·532, water 1·120, silica 0·513, *Turner*.

P. L. Cornwall, Devonshire, Thuringia, Moravia, Saxony, Hungary, France, &c., in primitive and transition rocks. It is the "Manganese Ore" of commerce.

CUPREOUS MANGANESE.

H. about 1·5; Sp. gr. 3·15—3·25; C. bluish-black; Sk. unchanged; L. resinous, inclining to semi-metallic.

Infusible. Giving with soda, on the platina wire, the reaction of manganese.

See Part I, Div. II, Sec. 7, B.

Group II.

NATIVE BISMUTH.

Id. Phil., Beud.; Octahedral Bismuth, *M.*

H.=2·0—2·5; Sp. gr. 9·6—9·8; C. silver-white, with a reddish tinge, but generally tarnished externally; Sk. unchanged; powder, blackish; sectile, inclining to malleable; opaque; L. metallic. It occurs massive, disseminated, arborescent, in plumose leaves, &c., and crystallized (fig. 8), the crystals grouped together. P. F. the octahedron.

Easily fusible into a globule, which flattens under the hammer, but breaks at the same time. On the blast being continued, this globule may be entirely volatilized, depositing a yellow oxide on the charcoal. Partly soluble in nitric acid, the solution yielding a white precipitate on the addition of water.

C. P. Pure bismuth, sometimes alloyed with minute portions of arsenic.

P. L. Cornwall, Saxony, Bohemia, France, Norway, &c., in veins in granite, and primitive and transition rocks, chiefly with ores of silver, arsenic, cobalt, and lead.

NATIVE TELLURIUM.

Id. Phil.; Tellure, *Beud.*; Rhombohedral Tellurium, *J.*; Gediegen Sylvan, *W.*; Aurum Problematicum.

H.=2·0—2·5; Sp. gr. 6·1—6·2; C. tin-white; powder, blackish; brittle; L. metallic. It occurs in small granular concretions, disseminated, and in minute indistinct hexahedral prisms.

Before the blow-pipe on charcoal it melts instantly, burning with a greenish flame, and on the heat being increased, it is almost entirely volatilized in a white vapour, having generally the odour of decayed horseradish, derived from a minute admixture of selenium.

In the open tube it gives off copious fumes, which adhere to the sides of the glass in the form of a white powder, capable of fusion into clear colourless drops.*

Soluble in nitric or muriatic acid, with very little residue.

* This effect is one of the chief characteristics of Tellurium. See Berzelius 'On the Blow-pipe,' page 111 of Mr Children's translation.

- C. P. Pure Tellurium, occasionally alloyed with small portions of iron, gold, &c., as in the following analysis by *Klaproth*:—Tellurium 92·55, iron 7·20, gold 0·25.
- P. L. Facebay, near Zalathna in Transylvania, in veins in sandstone. It is very rare.

NATIVE ANTIMONY.

- Id. Phil.*; Antimoine, *Beud.*; Rhombohedral Antimony, *M.*; Gediegen Speissglanz, *Haus.*
- H.=3·0—3·5; Sp. gr. 6·5—6·8; C. tin-white; powder, blackish; brittle, inclining to sectile; L. metallic. It occurs massive, reniform, in lamellar concretions, and disseminated. P. F. derived from the crystals produced by fusion, an obtuse rhomboid of 117° 15' and 62° 45' (*Haid.*).
- Fusible, and entirely volatilizable, burning with a pale bluish-green flame. The areola, which in volatilizing it deposits on the charcoal, is quite white, whilst those deposited by the two preceding minerals are more or less of a yellow or reddish colour.
- Partly soluble in nitric acid, the solution immediately throwing down a white precipitate.
- C. P. Pure antimony; occasionally alloyed with minute portions of arsenic, &c., in which case it emits in volatilizing an alliaceous odour.
- P. L. Dauphiné; Andreasberg in the Hartz; Sweden; Mexico, Connecticut, &c., in metalliferous veins in primitive rocks, chiefly accompanying ores of arsenic, antimony, and cobalt.

STIBINE. SULPHURET OF ANTIMONY.

- Stibine, *Beud.*; Sulphuret of Antimony, *Phil.*; Prismatoidal Antimony Glance, *M.*; Grey Antimony.
- H.=2·0; Sp. gr. 4·2—4·7; C. lead-grey; powder, black; brittle and easily frangible; L. metallic. It occurs massive, in radiated and fibrous concretions, and crystallized (fig. 198 and 200).
- P. F. a right rhombic prism of 91° 20' and 88° 40'.
- Very easily fusible (even in the flame of a candle), and burning with a greenish flame. On charcoal it sinks into the support, but in the open tube it is entirely volatilized with a sulphureous odour.
- C. P. Sulphur 26, antimony 74, *Bergmann.*
- P. L. Hungary, Saxony, Transylvania, Cornwall, France, &c., in granite and primitive rocks. The finest specimens are brought from Transylvania and Hungary, and have often a beautiful iridescent tarnish. It is the "Antimony Ore" of commerce.

BISMUTHINE. SULPHURET OF BISMUTH.

- Id. Beud.*; Sulphuret of Bismuth, *Phil.*; Prismatic Bismuth Glance, *M.*; Wismuthglanz, *W.*
- H.=2·0—2·5; Sp. gr. 6·1—6·55; C. light lead-grey, inclining to yellowish or tin-white; powder, blackish; brittle; L. metallic. It occurs massive, in small fibrous concretions, and in minute and acicular four-sided prisms striated longitudinally. P. F. a slightly oblique rhombic prism (?).
- Before the blow-pipe it fuses with extreme ease, and is entirely, or almost entirely, volatilized, the charcoal being covered with a yellowish areola of oxide of bismuth.

Soluble in heated nitric acid, the solution yielding a white precipitate on the addition of water.

C. P. Sulphur 18·72, bismuth 80·98, *H. Rose*.

P. L. Cumberland, with the molybdenite, &c.; Cornwall; Sweden; Bohemia; Saxony, &c.; chiefly in primitive rocks, but it is not a common mineral.

Group III.

CHALKOSINE. SULPHURET OF COPPER.

Chalkosine, *Beud.*; Sulphuret of Copper, *Phil.*; Prismatic Copper Glance, *M.*; Vitreous Copper.

H.=2·5—3·0; Sp. gr. 5·5—5·8; C. dark lead-grey, inclining to iron-grey; Sk. black; sectile; L. metallic. It occurs massive, and crystallized (fig. 93, 98, 106, 107, 117, 119, 121, and 123). P. F. an acute rhomboid of 71° 30' and 108° 30'.

Fusible in the O. F., with bubbling, into a grey globule, which in the R. F. loses its globular form and becomes converted into a kind of scoria, containing in its centre a malleable bead of copper.

C. P. Sulphur 20·62, copper 77·16, iron 1·45, from Cornwall, *Thomson*.

P. L. Cornwall, Moldawa in the Bannat, Siberia, Saxony, Hessia, &c., chiefly accompanying copper pyrites.

BREITHAUPTE.

Kupferindig, *Breithaupt, Phil.*

H.=2·0—2·5; Sp. gr. 3·8—3·85; C. dark bluish-black; Sk. black; sectile; opaque; L. semi-metallic, or metallic. It occurs massive, and flat botryoidal.

Fusible rapidly into a brittle grey globule, containing in its centre a small malleable bead of copper.

C. P. Sulphur 32·64, copper 64·77, lead 1·05, iron 0·46, *Walchner*.

L. Sangerhausen in Thuringia, in graywacke. It is a scarce substance, and was first distinguished by Breithaupt, the discoverer of so many new species, after whom I have named it.

PHILLIPSINE, OR PURPLE COPPER PYRITES.

Phillipsite, *Beud.*; Purple Copper, *Phil.*; Octahedral Copper Pyrites, *M.*; Variegated Copper Ore; Buntkupfererz, *W.*

H.=3·0; Sp. gr. 4·9—5·1; C. between copper-red and pinchbeck-brown, but it soon acquires an iridescent tarnish, in which the blue colour generally predominates; Sk. greyish-black; slightly sectile; L. metallic. It occurs massive, and crystallized (fig. 23, &c.). P. F. the regular octahedron.

Fusible into a brittle grey globule, which attracts the magnet, and yields with the fluxes a bead of copper.

C. P. Sulphur 23·75, copper 61·07, iron 14·00, silica 0·50, loss 0·58, *R. Phillips*.

P. L. Cornwall, Arendal in Norway, Freyberg in Saxony, Siberia, Thuringia, Ireland, Mexico, &c., chiefly with chalkosine and copper pyrites.

Note.—The name of "*Phillipsite*," as bestowed upon this substance by Beudant in honour of the well-known chemist, having been already given to another mineral in honour of his brother, the late W. Phillips, Esq.

(author of the 'Introduction to Mineralogy,' &c.), I have changed its termination to avoid confusion, hoping thereby that Mineralogists will retain them both in the system.

FAHL-ORE, OR GREY COPPER.

Grey Copper, *Phil.*; Tetrahedral Copper Glance, *M.*; Panabase and Tennantite, *Beud.*; Fahlerz.

Note.—There is little doubt that this substance, as described by authors, includes several distinct species, but so much confusion prevails respecting them that it is impossible as yet to separate them rigorously one from another. I have therefore retained the old name as the most convenient for a time, until this desired end be accomplished.

H.=3.0—4.0; Sp. gr. 4.4—5.2; C. steel-grey, lead-grey, iron-black; Sk. black, in some varieties reddish or brownish; brittle; L. metallic. It occurs massive, and crystallized (fig. 1 to 7, *Grey Copper*, and 9, 21, 29, 30, 31, &c., *Tennantite*). P. F. the tetrahedron or octahedron (cubic system of crystallization). Before the blow-pipe all the varieties fuse with antimonial or arsenical fumes, and usually with bubbling, into a grey globule, or scoria, which generally attracts the magnet, and gives always with borax a bead of copper.

C. P.	(1)	(2)	(3)	(4)
Sulphur .	24.73	26.83	18.50	28.74
Antimony .	23.24	12.46	23.00	
Arsenic .		10.19	0.75	11.84
Copper .	34.48	40.60	40.25	45.32
Iron .	2.27	4.66	13.50	9.26
Silver .	4.97	0.60	0.30	
Zinc .	5.55	4.66		

- (1) From Clausthal, containing antimony, no arsenic, and a little iron, *Rose*.
- (2) From Ste. Marie-aux-Mines, containing antimony, arsenic, and a little iron, *Rose*.
- (3) From the Tyrol (?), containing antimony, scarcely any arsenic, and a considerable portion of iron, *Klapr.*
- (4) From Cornwall (Tennantite), containing arsenic, no antimony, and iron, *R. Phillips*.

Note.—Zinc and Silver occurred in all the seven crystallized specimens analysed by *M. H. Rose*; the former being in the proportions of from 0.99 to 7.29, the latter from 0.60 to 31.29.*

P. L. Cornwall; Freyberg in Saxony; Andreasberg and Clausthal in the Hartz; Schwartz in the Tyrol; Hungary, &c., in veins in granite and primitive rocks, with copper pyrites and other ores.

BOURNONITE.

Id. Beud., Phil., &c.; Diprismatic Copper Glance, *M.*; Endellione; Triple Sulphuret; Bleifahlerz; Radelerz.†

H.=2.5—3.0; Sp. gr. 5.7—5.8; C. steel-grey, lead-grey, often blackish; Sk. black; brittle; L. metallic. It occurs massive and crystallized (fig. 139 the P. F., 140, 142, 144, 147, 148, 190 257). P. F. a right rectangular prism.

Before the blow-pipe it decrepitates violently, and then fuses into

* The mean of all the analyses would give, for the zinc 3.53, and for the silver 7.63.

† "Wheel-ore:" this refers to the curiously maced varieties from Kapnik in Transylvania.

a black globule containing a bead of copper. During fusion, sulphureous and antimonial fumes are evolved, and a yellowish areola of oxide of lead surrounds the assay.

C. P. Sulphur 20, antimony 25, lead 41, copper 13, from Cornwall, *Smithson*.

P. L. Cornwall, the Hartz, Transylvania, Saxony, &c., in veins with ores of lead and copper.

AIKENITE.

Needle Ore, *Phil.*; Bismuth Sulphur^é plombo-cuprifère, *H.*; Nadelierz, *W.*

H.=2·0—2·5; Sp. gr. 6·1—6·15; C. dark-lead or steel-grey, generally with a yellow or reddish tarnish; brittle; L. metallic.

It occurs in needle-like four or six-sided prisms, longitudinally striated.

Fusible, with bubbling, into a brittle globule containing a bead of copper, a yellow areola surrounding the assay.

C. P. Sulphur 11·58, bismuth 43·20, lead 24·32, copper 12·10, nickel 1·58, tellurium 1·32, *John*.

L. Ekatherinenburg in Siberia, in quartz, with gold, galena, malachite, &c.

Note.—This substance not having hitherto possessed any general appellation applicable to all languages, I have ventured to name it in honour of the author of the well-known and once-popular 'Manual of Mineralogy.'

SULPHURET OF BISMUTH AND COPPER.

Cupreous Bismuth, *Phil.*; Kupferwismuthertz, *W.*

H.=2·0—2·5 (?); Sp. gr. over 6·0; C. steel-grey, inclining to tin-white, but tarnished externally like the preceding species; brittle, inclining to sectile; L. metallic. It occurs in fibrous concretions or small tufts of acicular crystals.

Fusible and partly volatilizable, leaving a bead of copper.

C. P. Sulphur 12·58, bismuth 47·24, copper 34·66, *Klapr.*

P. L. The mines of Daniel and Neuglück, near Wittichen in Furstenburg, with copper pyrites, &c., in granite. It is a rare mineral.

STROMEYERINE.

Id. Beud.; Sulphuret of Silver and Copper, *Phil.*; Silberkupferglanz, *Strom.* and *Haus.*

H.=3·0—4·0; Sp. gr. 6·2—6·3; C. steel-grey; Sk. blackish; very easily frangible; L. metallic. It occurs in small compact masses.

Very easily fusible into a grey globule, which yields with the fluxes indications of copper.

Soluble in nitric acid; the solution yielding precipitates of copper and silver on bars of iron and copper.

C. P. Sulphur 15·96, silver 52·87, copper 30·83, iron 0·34, *Strom.*

L. Schlangenbergr in Siberia, with copper pyrites, &c. It is very rare.

EUKAIRITE.

Id. Berz.; Euchairite, *Beud.*; Seleniuret of Silver and Copper, *Phil.*

H. about 2·0; C. lead-grey, blackish; Sk. black; sectile; L. metallic. It occurs in disseminated superficial masses.

Fusible into a brittle grey globule, giving out at the same time the strong odour of decayed horseradish, characteristic of selenium. With borax it gives indications of copper.

C. P. Selenium 26·00, silver 38·93, copper 23·05, earthy matter 8·90, carbonic acid and loss 3·12, *Berz.*

L. Skrickerum in Smaland, Sweden, with carbonate of lime, &c., in copper veins. It is very rare.

Note.—Selenium, in all its combinations, sublimes in the form of a red powder when heated in the matrass.

BERZELINE.

Id. Beud. ; Seleniuret of Copper, *Phil.* ; Selen Cuprite.

C. silver-white, generally tarnished black ; soft ; very sectile ; L. metallic. It occurs in compact superficial coatings, or in small dendritic masses in calc-spar.

Fusible into a grey and slightly malleable globule, exhaling at the same time the odour of selenium. With the fluxes it gives a bead of copper.

C. P. Selenium 40, copper 64, *Berz.*

L. Skrickerum in Smaland, Sweden, with the preceding species.

Note.—A seleniuret of lead and copper, of a grey colour and very sectile, occurs at Tilkerode, in the Hartz. It yielded to *Rose* : selenium 34·26, lead 47·43, copper 15·45, silver 1·29.

POLYBASITE.

Id. Beud., Phil., &c.

H.=2·0—3·0 ; Sp. gr. 6·2—6·25 ; C. iron-black ; Sk. black ; sectile ; L. metallic. It occurs in flat six-sided prisms, the lateral planes of which are horizontally striated. P. F. a rhomboid.

Before the blow-pipe it gives out sulphureous and arsenical fumes, and melts into a greyish and slightly malleable globule, but if it be previously well roasted, the globule is of a lighter colour and perfectly malleable. With borax it gives indications of copper, and yields on cupellation a considerable bead of silver.

In nitric acid it dissolves in chief part, with an immediate though slight precipitate of antimony, and the silver may be obtained from the solution on a bar of copper.

C. P. Sulphur 17·04, antimony 5·09, arsenic 3·74, silver 64·29, copper 9·93, iron 0·06, *H. Rose.*

P. L. Guarisamay in Mexico ; Freyberg in Saxony, and probably other places, where it is confounded with the Psaturose or Brittle Sulphuret of Silver, but as yet it is very scarce.

DONACARGYRITE.

Schilfglaserz, *Freisleben* ; Sulphuret of Silver and Antimony, *Phil.* ; Peritinous Antimony Glance, *M.* ; Donacargyrite.*

H.=2·0—2·5 ; Sp. gr. 5·5—5·6 ; C. steel-grey inclining to silver-white ; brittle ; L. metallic. It occurs in very small crystals longitudinally striated, also in small striated masses (?). P. F. a right rhombic prism of 100° and 80°.

Fusible and partly volatilizable, a bead of silver slightly alloyed with copper (?) remaining.

C. P. Sulphur, antimony, silver, and copper (?).

P. L. Freyberg in Saxony, and Kapnik in Transylvania, with ores of silver, lead, &c. ; but it is exceedingly rare.

Group IV.

SYLVANITE.

Id. Beud. ; Graphic Tellurium, *Phil.* ; Prismatic Antimony Glance, *M.* ; Schriffterz, *W.*

* I am ignorant of the namer of this mineral. I take it from the Catalogue of the British Museum.

H.=1.5—2.0; Sp. gr. 5.7—5.8 (?); C. steel-grey; sectile; powder, blackish; L. metallic. It occurs massive, disseminated, and in small thin crystals (fig. 214), generally grouped together in the matrix in the form of Persepolitan characters. P. F. a right rhombic prism of about $107^{\circ} 40'$ (?).

Easily fusible, the tellurium being driven off, and a perfectly malleable yellowish bead being left on the charcoal.

Partly soluble in nitric acid, the gold remaining undissolved.

C. P. Tellurium 52.0, gold 24.0, silver 11.3, lead 1.5, *Berz.*

P. L. Offenbanya and Nagyag in Transylvania, with quartz, gold, mullerine, elasmose, and other minerals, in narrow veins in a porphyritic rock.

ELASMOSE.

Id. (*ελασμος*, a blade)* *Beud.*; Black Tellurium, *Phil.*; Pyramidal Tellurium Glance, *M.*; Nagyag-erz, *W.*; Foliated Tellurium; Blatter-tellur.

H.=1.0—1.5; Sp. gr. 7.0—7.2; C. very dark or blackish lead-grey; powder, black; sectile; flexible in thin laminae; L. metallic. It occurs disseminated, in small foliated masses, and crystallized (fig. 61, 63*a*). P. F. right square prism.

Easily fusible into a malleable globule, the charcoal being covered at the same time with yellowish oxide of lead.

C. P. Tellurium 26.40, lead 46.00, gold 7.50, copper 1.00, sulphur 2.50, *Brandes.*

P. L. The same as those of the Sylvanite.

MULLERINE.

Id. *Beud.*; Yellow Tellurium, *Phil.*; Weiss Tellur.

H.=2.0; Sp. gr. 8.9—10.7; C. yellowish-white, or silver-white, inclining to brass-yellow; sectile in a slight degree; not flexible; L. metallic. It occurs disseminated, in delicately fibrous masses and in very small crystals (fig. 140, 141, 146). P. F. a right rhombic prism of about $105^{\circ} 30'$ and $74^{\circ} 30'$.

Fusible into a white malleable globule, the charcoal being covered with oxide of lead.

Partly soluble in nitric acid, the gold remaining undissolved.

C. P. Tellurium 44.75, gold 26.75, lead 19.50, silver 8.50, sulphur 0.50, *Klapr.*

P. L. Nagyag in Transylvania, with the two preceding tellurets. The Altai Mountains in Siberia.

Note.—This species was thus named by Beudant, in honour of Muller, the discoverer of tellurium.

TELLURET OF SILVER.

Telluric Silver, *Phil.*; Tellur Silber, *Rose.*

H. about 2.0—2.5; Sp. gr. 8.41—8.56; C. steel or lead-grey; sectile, inclining to malleable; L. metallic.

Fusible into a malleable bead, and soluble in nitric acid, the silver precipitated from the solution on a bar of copper.

C. P. Tellurium 36.96, silver 62.42, iron 0.24, *Rose.*

P. L. The Altai Mountains, Siberia.

BORNINE. TELLURET OF BISMUTH.

Id.† *Beud.*; Telluric Bismuth, *Phil.*; Rhombohedral Bismuth Glance, *M.*; Molybdena Silver.

* In allusion to its foliated structure.

† Named in honour of Baron Von der Born, by whom it was first described, under the title of Wasserbleysilber.

H.=1.5—2.0; Sp. gr. 7.2—8.0; C. pale steel-grey, inclining to light bluish-grey; powder, black; slightly sectile; flexible in thin laminae; L. metallic. It occurs in small foliated masses, sometimes presenting an hexagonal form.

Easily fusible into small white globules, which quickly take a yellowish tarnish, the charcoal being covered at the same time with an orange-yellow or brownish crust of oxide of bismuth. During fusion the odour of selenium is generally developed, and in the open tube the characteristic effects of tellurium are produced. (See Native Tellurium.)

C. P. Tellurium 29.74, bismuth 61.15, sulphur, with traces of selenium, 2.33, silver 2.07, *Wehrle*.

P. L. Deutch Pilsen in Hungary, with brown-spar and iron-flint; also near Schernowitz on the Gran, in the same country. Tellermarken in Norway, and Riddarhyttan and Bastnaes in Sweden, are likewise described as localities of this substance, but it is extremely rare.

NATIVE AMALGAM.

Id. Phil.; Amalgame, *Beud.*; Dodecahedral Mercury, *M.*; Hydrarguret of Silver.

H.=1.0—3.5; Sp. gr. 10.5—14.12; C. silver-white; brittle or slightly sectile; L. metallic. It occurs sometimes in a semi-fluid, but more commonly in a solid state; and is then either in small masses, or crystallized (fig. 8, 9, 12, 13, 28, 29, and 33). Structure, compact, uncleavable, but the rhombic dodecahedron is adopted as the P. F.

Before the blow-pipe the mercury is volatilized, a bead of silver remaining on the charcoal.

C. P.	Mercury	.	.	64	.	72.5
	Silver	.	.	36	.	27.5

Klapr. *Cordier.*

From which it appears that there are either two distinct species of amalgam, or that its proportions are not constant. Future analyses may probably show that, like the compounds termed *electrum* and *auriferous silver*, the latter is the case.

P. L. Moschellandsberg in the Palatinate; Rosenau in Hungary; Spain, France, &c., chiefly with Native Mercury and Cinnabar.

CLAUSTHALITE.

Clausthalie, *Beud.*; Seleniuret of Lead, *Phil.*; Selenblei.

H. about 2.0—2.5; Sp. gr. 6.8—7.8 (8.2—8.3, *Haid.*); C. bluish lead-grey; powder, black; sectile; L. metallic. It occurs in small lamellar masses; system of crystallization, cubical (?).

Fusible, and partly volatilizable, with the peculiar odium of selenium, a globule of lead being left on the charcoal, surrounded by the yellowish oxide of the same metal. In the matrass the selenium is sublimed, and forms a red ring or powder in the upper part of the glass. Soluble, in chief part, in nitric acid, the lead precipitated on a bar of zinc.

C. P. Selenium 28.11, lead 70.98, cobalt 0.83, *Strom.*

P. L. Clausthal and Tilkeroide in the Hartz. At the latter locality the following seleniurets also occur.

SELENIURET OF LEAD AND MERCURY.

Sp. gr. 7.8—7.87; C. grey, or almost iron-black; sectile; in lamellar masses, presenting a cubical cleavage, and which gives when heated in the matrass, a yellow sublimation of seleniuret of mercury.

C. P.	Selenium . . .	24·97 . . .	27·98
	Mercury . . .	16·94 . . .	44·69
	Lead . . .	55·84 . . .	27·33
		<i>Rose.</i>	<i>Rose.</i>

SELENIURET OF LEAD AND COBALT.

Sp. gr. 7·697; C. bluish lead-grey; sectile. It yielded to *Rose*: selenium 31·42, lead 63·92, cobalt 3·14, iron 0·45, and seems to differ very little from the *clausthalite*; in fact, in 'Allan's Manual,' and in the last edition of 'Phillips's Mineralogy,' the very same analyses are given for one substance as for the other.

SELENIURET OF LEAD AND COPPER.

This has been described above, as an appendix to the *Berzeline* or *Seleniuret of Copper*, which see.

SELENIURET OF SILVER AND LEAD.

Sp. gr. 8·0; C. dark lead-grey; sectile.

C. P. Seleniuret of silver 89·71, seleniuret of lead 6·79, *H. Rose*.

PSATUROSE.

Id. (*Ψαθυρος*, fragile) *Beud.*; Brittle Sulphuret of Silver, *Phil.*; Prismatic Melane Glance, *M.*; Black Silver Glance; Spröd-Glaserz, *W.*

H.=2·0—2·5; Sp. gr. 5·9—6·4; C. dark lead-grey, passing into iron-black; powder, black; sectile; L. metallic. It occurs in small disseminated masses, and crystallized (fig. 212, 214). P. F. a right rhombic prism of 107° 47' and 72° 13'.

Easily fusible with sulphureous, antimonial, and occasionally with arsenical fumes. Partly soluble in nitric acid, with an immediate white precipitate of antimony. The silver deposited from the solution on a bar of copper.

C. P. Sulphur 16·42, antimony 14·68, silver 68·54, copper 0·64, *H. Rose*.

P. L. Schneeberg and Freyberg in Saxony; Schemnitz, &c., in Hungary; Bohemia, Mexico, and other countries, chiefly in primitive rocks, with antimonio- and arsenio-sulphurets, as well as with galena and stibine, with which it is often mechanically mixed.

ARGYRYTHROSE.

Sk. red; H.=2·0—2·5; Sp. gr. 5·8—5·9; C. dark-red; L. generally adamantine, occasionally semi-metallic.

Before the blow-pipe it decrepitates, and yields a bead of silver.

See Part I, Div. II, Sec. 6, B.

MIARGYRITE.

Sk. red; H.=2·0—2·5; Sp. gr. 5·2—5·4; C. iron-black; L. between adamantine and metallic.

Decrepitates before the blow-pipe, and yields a bead of silver.

See Part I, Div. II, Sec. 6, B.

BISMUTHINE. SULPHURET OF BISMUTH.

H.=2·0—2·5; Sp. gr. 6·1—6·55; C. pale lead-grey; powder, blackish. Almost entirely volatilizable before the blow-pipe. Soluble in heated nitric acid, the solution throwing down a white precipitate on the addition of water.

See Group II.

GALENA. SULPHURET OF LEAD.

Id. Phil.; Galene, *Beud.*; Hexahedral Lead Glance, *M.*; Bleiglanz, *W.*; Alquitoux.

H.=2.5—3.0; Sp. gr. 7.4—7.76; C. lead-grey, often blackish externally, or iridescently tarnished on the faces of the secondary crystalline forms; powder, black; rather sectile; very easily frangible, breaking into cubical fragments; L. metallic. It occurs massive, disseminated, botryoidal, &c., in thin specular coatings (*slickensides*), in lamellar, granular, and prismatic concretions, and crystallized (fig. 8, 9, 10, 12, 20, 21, 22, 23, and 25). P. F. the cube.

Before the blow-pipe it decrepitates violently, and melts, with sulphureous fumes, into a globule of lead.

C. P. Sulphur 13.02, lead 85.13, iron 0.5, *Thomson*; but it often contains silver, and also antimony, in various proportions. A variety, from Schemnitz, yielded to Beudant: sulphur 13.4, lead 79.6, silver 7.0.

P. L. Freyberg, &c., in Saxony; Strontian in Argyleshire; Sahla in Sweden; the Vosges in France; Massachusetts, N. A., in primitive rocks. Przibram, Mies, &c., in Bohemia; Clausthal, &c., in the Hartz; Poullaouen, &c., in Brittany; Leadhills in Scotland; Cornwall, and other places, in transition rocks. And Derbyshire, Durham, Cumberland, Northumberland, in England; Fifeshire in Scotland; Bleiberg, &c., in Carinthia; Tarnowitz in Silesia; various parts of Poland, Mexico, &c., in the lower secondary rocks, chiefly in the carboniferous limestone. It is also found in small quantities in the Lias Limestone, in several parts of the continent.

Appendix.

SUPER-SULPHURET OF LEAD.

H.=2.75—3.0; Sp. gr. 6.71—6.72; C. lead-grey; powder, black; structure, fine granular, almost compact; L. metallic. It occurs massive.

Before the blow-pipe it burns with a blue flame and sulphureous odour, and melts into a globule of lead.

C. P. Galena 98.21, sulphur 1.79, or seven atoms of lead and eight atoms of sulphur, *Thomson*.

L. Dufton in Cumberland.

JAMESONITE.

Id. Beud., Phil.; Axotomous Antimony Glance, *M.*; Jamesonite, *Haid.*

H.=2.0—2.5; Sp. gr. 5.5—5.8; C. steel-grey; powder, blackish; sectile; L. metallic. It occurs massive, and in fibrous concretions, which are often radiated. P. F. a right rhombic prism of about $101^{\circ} 20'$ and $78^{\circ} 40'$.

Easily fusible,* with sulphureous and antimonial fumes, a globule of lead being left on the charcoal.

C. P. Sulphur 22.15, antimony 34.40, lead 40.75, iron 2.30, copper 0.13, *Rose*.

P. L. Cornwall, with quartz and bournonite; Hungary; Siberia.

ZINKENITE.

Id. Beud., Phil., Rose.

H.=3.0—3.5; Sp. gr. 5.3—5.35; C. pale steel-grey; powder, blackish; L. metallic. It occurs massive (?), in small fibrous concretions, and in six-sided prisms longitudinally striated, and terminated at each end by a flat six-sided pyramid; cleavage, not perceptible.

Decrepitates. Easily fusible, the charcoal being covered with the yellowish oxide of lead.

C. P. Sulphur 22.58, antimony 44.11, lead 31.97, copper 0.42, *Rose*.

L. Wolfsberg in the Hartz.

* It decrepitates unless gently heated.

Note.—This mineral may be distinguished from the *Jamesonite* by its inferior specific gravity, and higher degrees of hardness. It was named by Dr Rose, of Berlin, in honour of M. Zinken, its discoverer.

Appendix.

PLAGIONITE.

Id. Zinken, Rose.

H.=2·5; Sp. gr. 5·4; C. dark lead-grey. Occurring in small oblique four-sided prisms. Comportment before the blow-pipe similar to that of the *zinkenite*.

C. P. Sulphur 21·53, antimony 37·94, lead 40·52, *H. Rose*.

L. Wolfsberg in the Hartz.

BERTHIERITE.

Id. Haid., Phil.; Haidingerite, Berthier, Beud.

H. about 2·5—3·0; Sp. gr. under 5·0; C. dark steel-grey, with a brownish-tinge; powder, black; brittle; L. metallic. It occurs massive, and in lamellar and prismatic concretions.

Easily fusible, with sulphureous and antimonial fumes, into a black globule, attractable by the magnet, and producing, with borax, the effects of iron.

C. P. Sulphur 30·3, antimony 52·0, iron 16·0, zinc 0·3, *Berthier*.

L. Chazelles in Auvergne, forming a vein in gneiss, with quartz, iron pyrites, and other minerals.

DIVISION II.

SECTION I.

NATIVE PLATINUM.

Platine, *Beud.*; Native Platina, *Phil.*; Hexahedral Platina, *M.*

H.=4·0—4·5; Sp. gr. 16·0—20·0; C. steel-grey, inclining to silver-white; ductile and malleable; L. metallic. It occurs in flat or rounded grains, and in small pebbles.* Structure compact, uncleavable, but the cube is assumed as the P. F.

Infusible, either alone or with the fluxes.

Soluble only in heated nitro-muriatic acid, the solution yielding a yellow precipitate, with the muriates of ammonia and potassa, and a dark-brown precipitate, with hydro-sulphuric acid, which becomes black when dry.

C. P. Platinum more or less mixed with small quantities of iron, rhodium, palladium, iridium, osmium, &c.

P. L. Choco, &c., in South America, the Brazils, St Domingo, Siberia, in alluvial deposits, with native gold, zircons' magnetic iron-sand, &c.

NATIVE PALLADIUM.

Id. Phil., Beud.; Octahedral Palladium, *Haid.*

H.=4·5—5·0; Sp. gr. 11·5—12·5; C. steel-grey, inclining to silver white; ductile and malleable; L. metallic. It occurs in small grains, possessing a fibrous structure; no cleavage, but the octahedron is assumed as the P. F.

* In some very rare instances, masses of a considerable size have been found.

Infusible *per se*,* but easily fusible with sulphur, which is dissipated on the heat being continued, a globule of palladium remaining on the charcoal.

Soluble in heated nitric acid; colour of solution, red; a metallic precipitate being formed in it by proto-sulphate of iron.

C. P. Palladium, mixed with small portions of platinum, &c.

P. L. The Brazils, and Siberia, with native platinum.

NATIVE IRON.

Id. Phil.; *Fer, Beud.*; Octahedral Iron, *M.*; Bolide; Meteor-eisen; Gediegen-eisen.

H.=4·5; Sp. gr. 7·4—7·8; C. pale steel-grey, inclining to bluish-white; malleable, sometimes brittle; L. metallic. Attractable by the magnet. It occurs in ramose and cavernose masses, and disseminated in lava and in meteoric stones. Structure, compact, uncleavable, but the octahedron is assumed as the P. F.

Infusible *per se*. Soluble in nitric acid with the disengagement of nitrous gas; colour of solution, greenish; a black precipitate being formed in it by infusion of galls.

C. P. Iron more or less mixed with nickel, cobalt, &c., as in the following analysis:—

	(1)	(2)	(3)	(4)
Iron . . .	98·6	93·40	87·35	94·5
Nickel . . .	1·2	6·62	2·50	
Cobalt . . .		0·53		
Sulphur . . .			1·85	
Silica . . .			6·00	
Magnesia . . .			2·10	
Carbon . . .			0·50	4·3
Phosphoric Acid . . .				1·2

(1) From Siberia, by *Klaproth*.

(2) From Atacama, by *Turner*.

(3) From Brahin, by *Laugier*; the silica and magnesia probably derived from an admixture of *olivine*.

(4) From the coal formation of Saint Memin (?) in France, by *Godon*.†

P. L. Various parts of North and South America, Africa, Siberia, France, &c., in meteoric stones, lava, &c., as above described, and occasionally in the vicinity of ignited coal-seams.

SECTION 2.

A.

Remarks.—The few minerals included in this Sub-section are arranged in the three following Groups:—

Group 1. *Colour*, yellow, or copper-red.

Group 2. *Colour*, white, or pale steel-grey.

Group 3. *Colour*, neither yellow, copper-red, white, nor pale steel-grey.

* Difficultly fusible, according to *Beudant*: *Min*, t. 11, p. 722.

† See *Beudant's Min.* t. 11, p. 689.

Group I.

CAPILLOSE. SULPHURET OF NICKEL.

Harkise, *Beud.*; Haarkies, *W.*; Sulphuret of Nickel, *Phil.*; Capillary Pyrites; Hair Pyrites; Schwefel-Nickel.

H.=3.0—4.0; Sp. gr. 6.45; C. brass-yellow, inclining to steel-grey; powder, blackish; L. metallic. It occurs in small filamentous tufts, and in capillary crystals of indeterminable form.

Fusible, with sulphureous fumes, into a malleable and magnetic globule, which is soluble in nitric acid, tinging it green, but the solution on the addition of ammonia becomes of a violet colour.

C. P. Sulphur 35.24, nickel 64.76, *Arfwedson*.

P. L. St Austle in Cornwall, Johanngeorgenstadt in Saxony, Joachimsthal in Bohemia, and Andreasberg in the Hartz, in primitive and transition rocks, with ores of silver, cobalt and other substances; but it is still a scarce mineral. It is the *Native Nickel* of the older Mineralogists.

COPPER PYRITES. SULPHURET OF COPPER AND IRON.

Chalkopyrite, *Beud.*; Copper Pyrites, *Phil.*; Pyramidal Copper Pyrites, *M.*; Kupferkies, *W.*; Yellow Copper Ore.

H.=3.5—4.0; Sp. gr. 4.15—4.3; C. brass-yellow, often with a variegated tarnish; Sk. greenish-black, the green tinge being very perceptible; brittle, inclining to rather sectile; L. metallic. It occurs massive, botryoidal, &c. (*blistered copper pyrites*), disseminated, and crystallized in modified tetrahedrons, (resembling fig. 1 to 7;) also in macled crystals (fig. 251). P. F. an octahedron (rather acute) with square base, measuring in a lateral direction $102^{\circ} 30'$, and in a longitudinal direction (or across the base) $125^{\circ} 30'$.

Fusible into a brittle globule, which attracts the magnet, and gives with the fluxes a bead of copper.

C. P. Sulphur 35.16, copper 30.00, iron 32.20, from Cornwall, *R. Phillips*.

P. L. Fahlun, &c., in Sweden; Moldawa, Oravitz, &c., in the Bannat; Freyberg, &c., in Saxony; the Hartz; Hungary; Bohemia; Silesia; France; Norway, &c. &c., and particularly Cornwall, in primitive and transition rocks. Also, Mansfield in Thuringia; Prausnitz, &c., in Silesia; Yorkshire; various parts of South America, and other countries, in secondary rocks. It occurs in veins and large beds, and is usually associated with iron pyrites, fahl-ore, phillipsine, mispickel, zinc-blende, galena, and quartz.

IRON PYRITES.

Id. Phil.; Pyrite, *Beud.*; Hexahedral Iron Pyrites, *M.*; Schwefelkies, *W.*; Pyrite Martiale; Eisenkies; Marcassite.

H.=6.0—6.5; Sp. gr. 4.6—5.05, that of the purest specimens about 4.9; C. brass or bronze-yellow, generally paler than the colour of the last species; Sk. brownish-black; brittle; L. metallic. It occurs massive, disseminated, globular, cellular, and crystallized (fig. 8 to 12, 16 to 20, 22, 24, &c., the faces of the cubes being often striated in contrary directions). P. F. the cube.*

* This substance has also an octahedral cleavage.

Becomes red before the blow-pipe in the O. F., and fuses, with sulphureous fumes, into a brittle globule, which attracts the magnet.

C. P.	Sulphur	. . . . .	54.26	. . . . .	52.15
	Iron	. . . . .	45.74	. . . . .	47.85
			<i>Berz.</i>		<i>Hatch.</i>

It is sometimes mechanically mixed with minute portions of gold and silver, and these varieties have been termed *Goldkies* and *Silberkies*. It likewise occasionally contains arsenic, owing to an admixture of Mispickel, Smaltine, or other arsenical ores.

P. L. These are so numerous that only a few can be here enumerated; viz., Cornwall; Derbyshire; Elba; Traversella in Piedmont; Persberg and Fahln in Sweden; Freyberg in Saxony; Bohemia; Norway; Peru; Brazil, &c. It occurs chiefly in granite, and in primitive and transition rocks, but it is also found in secondary and tertiary strata, and likewise in the lavas of Vesuvius.

Note.—The substance termed “Hepatic Pyrites,” is both this and the following species converted (either wholly or in part) by decomposition into Hydrous Oxide of Iron, still, however, retaining its ancient form.

RADIATED IRON PYRITES.

Sperkise, *Beud.*; White Iron Pyrites, *Phil.*; Prismatic Iron Pyrites, *M.*; Speerkies; Kamkies; Strahlkies; Zerkies; Cockscorn Pyrites.

H.=6.0—6.5; Sp. gr. 4.65—4.9; C. brass or bronze-yellow, generally pale, and inclining to steel-grey in some varieties; Sk. brownish-black; brittle; presenting in the fracture a radiated structure; L. metallic. It occurs massive, reniform, globular, stalactitic, &c., in radiated prismatic and lamellar concretions, and crystallized (fig. 153, 177, 178, 185, and 186). Also in macles (fig. 254 and 254a). P. F. a right rhombic prism of $106^{\circ} 2'$ and $73^{\circ} 58'$.

Its comportment before the blow-pipe resembles that of the last species.

C. P.	Sulphur	. . . . .	53.35	. . . . .	53.60
	Iron	. . . . .	45.07	. . . . .	45.66
	Manganese	. . . . .	0.70		
	Silica	. . . . .	0.80		
			<i>Berz.</i>		<i>Hatch.</i>

It is, therefore, like the common Iron Pyrites, a Bisulphuret of Iron.

P. L. Liebnitz and Altsattel, by Carlsbad, in Bohemia, in tertiary strata (the plastic clay in which the brown coal formation of that locality occurs). Also, the south-eastern parts of England, the northern part of France, &c., in the chalk and green sand formations;* and in Derbyshire and Cornwall, in veins with galena, &c., occurring at the latter locality in the form of delicate stalactitical concretions. It is very subject to decomposition, and is, therefore, often met with in a partially efflorescent state.

MAGNETIC IRON PYRITES.

Id. Phil.; Leberkise, *Beud.*; Rhombohedral Iron Pyrites, *M.*; Magnet-kies, *W.*

H.=3.5—4.5; Sp. gr. 4.4—4.7; C. between bronze-yellow and copper-red, usually tarnished brown; Sk. black; brittle; affects the magnet slightly; L. metallic. It occurs massive, in granular and lamellar concretions, and rarely crystallized (fig. 93, 105, and 106). P. F. the regular six-sided prism (system of crystallization, rhombic).

Before the blow-pipe it behaves like the two preceding species.

* Fine crystals occur in the vicinities of Dover and Folkstone.

- C. P. Sulphur 38·78, iron 60·32, *Rose*. It is, therefore, a Sulphuret of Iron containing a proportion of bi-sulphuret of iron,* but as this proportion varies in specimens from different localities, several distinct species of magnetic pyrites probably occur in nature. A specimen from Cornwall gave the following results: sulphur 36·5, iron 63·5, *Hatchett*; and another from Barèges: sulphur 43·63, iron 56·37, *Strom*.
- P. L. Bodenmais in Bavaria, with iolite, &c., in mica-schist; Kongsberg, &c., in Norway; Andreasberg in the Hartz; Hungary; the Pyrenees; Sweden; Argyleshire, Scotland; Cornwall, &c., in primitive and transition rocks. It has also been found disseminated in several meteoric stones.

Group II.

KOBOLDINE. SULPHURET OF COBALT.

Koboldine, *Beud.*; Sulphuret of Cobalt, *Phil.*; Isometric Cobalt Pyrites, *M.*; Schwefel Kobalt, *Berz.*; Cobalt-kies.

H.=5·5; Sp. gr. 6·3—6·4; C. white, with a slightly reddish tinge, or pale steel-grey; Sk. black; brittle; L. metallic. It occurs massive, in granular concretions, and, it is said, also crystallized (fig. 25). P. F. the cube, or the regular octahedron.

Fusible, with sulphureous fumes, into a brittle metallic globule, which attracts the magnet, and gives, after roasting, a blue glass with borax. Partly soluble in nitric acid, the solution coloured pale-red.

C. P.		(1)	(2)
Sulphur	.	41·0	38·50
Cobalt	.	43·86	43·20
Copper	.	4·10	14·40
Iron	.	5·31	3·50

(1) From Mussen, by *Wernekinck*.

(2) From Bastnaes, by *Hisinger*.

P. L. Bastnaes in Sweden, in gneiss, with copper-pyrites, &c.; Mussen near Siegen, in Prussia, with barytine and other minerals.

It may be distinguished immediately from either of the two following cobaltic ores, by its not giving out an alliaceous odour before the blow-pipe.

COBALTINE. ARSENIO-SULPHURET OF COBALT.

Cobaltine, *Beud.*; Bright White Cobalt, *Phil.*; Hexahedral Cobalt Pyrites, *M.*; Glanz Kobalt, *W.*

H.=5·5; Sp. gr. 6·2—6·35; C. silver-white, with a reddish-tinge; Sk. black; brittle; L. metallic. It occurs massive, aborescent, reticulated, and crystallized (fig. 8, 9, 16, 17, 18, 19, 20, 23, &c.) P. F. the cube.

Before the blow-pipe it gives off copious arsenical fumes, and then melts into a brittle and magnetic globule, which colours borax deep-blue. Roasted in the open tube, it emits also sulphureous fumes, which bleach Brazil-wood paper, placed at the upper part of the glass.

C. P. Sulphur 20·08, arsenic 43·47, cobalt 33·10, iron 3·23, *Strom*.

P. L. Tunaberg, Wehna, &c., in Sweden; Skutterud in Norway; Silesia; Cornwall; Connecticut; in primitive rocks, with copper pyrites, iron pyrites, aimantite, quartz, tourmaline, and other minerals.

* Fe Su²+6 Fe Su (*Beud.* 'Min.' t. 11, p. 405).

SMALTINE. ARSENIURET OF COBALT.

Smaltine, *Beud.*; Tin White Cobalt, *Phil.*; Octahedral Cobalt Pyrites, *M.*; Grauer Spieskobalt, *W.*; Cobalt Arsenical.

H.=5.5; Sp. gr. 6.4—6.7; C. tin-white, inclining in some varieties to steel-grey; Sk. black; brittle; L. metallic. It occurs massive, fruticose, reticulated, &c., in radiated concretions, and crystallized (fig. 8, 9, 20, 23, 25), the crystals being generally cracked in different directions. P. F. the regular octahedron, or the cube. Fusible, with copious arsenical fumes, into a brittle and magnetic globule, which (as in the two preceding instances) imparts to borax a deep-blue colour, and affords, with nitric acid, a pink solution.

C. P. Arsenic 65.75, cobalt 28.00 (oxides of iron and manganese 6.25), *John*.*
P. L. Schneeberg, Freyberg, &c., in Saxony; Hessia; Bohemia; Cornwall; in primitive and transition rocks.

MISPICKEL. ARSENIO-SULPHURET OF IRON.

Mispikel, *Beud.*; Arsenical Iron, *Phil.*; Prismatic Arsenic Pyrites, *M.*; Arsenik-kies (in part); Mispickel or Arsenical Pyrites; Marcassite (in part).

H.=5.5—6.0; Sp. gr. 5.7—6.2; C. silver-white or tin-white, with a yellowish-tinge, and sometimes inclining to steel-grey; Sk. black; brittle; L. metallic. It occurs massive, disseminated, in prismatic concretions (or aggregated capillary crystals), and crystallized (fig. 178, 179, 179 a). P. F. a right rhombic prism of $111^{\circ} 12'$ and $68^{\circ} 48'$.

Fusible, with copious arsenical fumes, into a brittle and magnetic globule.

C. P. Sulphur 21.08, arsenic 42.88, iron 36.04, *Strom*.

P. L. Cornwall; Freyberg, &c., in Saxony; Silesia; Bohemia; North America, &c.; chiefly in primitive rocks, with iron and copper pyrites, oxide of tin, barytine, and other minerals.

Note.—At Freyberg and Braunsdorf in Saxony, Andreasberg in the Hartz, Schemnitz in Hungary, Chili, &c., a variety occurs, containing accidentally-mixed silver in various proportions, which has been described under the names of “Weisserz,” “Argentiferous Arsenic Pyrites,” &c.

MOHSINE. ARSENIURET OF IRON.

Arsenical Pyrites, *Phil.*; Axotomous Arsenic Pyrites, *Möhs*; Arsenik-kies (in part), *W.*; Sesquiarseniet of Iron, *Thomson*.

H.=5.0—5.5; Sp. gr. 7.1—7.4; C. pale steel-grey, inclining to silver-white; Sk. black; brittle; L. metallic. It occurs massive, and occasionally crystallized (fig. 167 a). P. F. a right rhombic prism of $122^{\circ} 26'$ and $57^{\circ} 34'$.

Fusible, with arsenical fumes, into a brittle magnetic globule, which gives, with the fluxes, the reactions of iron.

C. P. Arsenic 65.99, sulphur 1.94, iron 28.06, *Hoffman*.

P. L. Richenstein in Silesia, in serpentine; Schladming in Styria, with the nickeline; Löling in Carinthia, with bismuth, &c., but as yet it is a scarce mineral.

Note.—This substance having no general name, I have bestowed upon it that of the able and celebrated Mineralogist by whom it was first distinguished, and to whom the science is in many respects so much indebted. It should

* The above is the analysis of the radiated fibrous variety from Schneeberg, which has been considered by some to be a distinct species, but further observations are requisite to determine this.

be mentioned, however, that the name of *Mohsite* has been given to another mineral;* but of this very little is known at present, so that it may not after all be proved to be a new species, and, in the meantime, the different terminations of these names will serve to keep them distinct from each other in the memory.

Group III.

FAHL-ORE. GREY COPPER.

H.=3·0—4·0; Sp. gr. 4·5—5·2; C. steel-grey, iron-black; Sk. black; L. metallic. System of crystallization, cubical.

Fusible, with arsenical or antimonial and sulphureous fumes, into a brittle globule, which attracts the magnet, and gives, with the fluxes, a bead of copper.

See Div. I, Sect. 3 (Gr. III).

LIEVRITE. ILVAITE.

L. inclining to metallic; H.=5·5—6·0; Sp. gr. 3·8—4·1; C. black, blackish-brown, greenish-black; Sk. brownish-black; occurring in radiated or divergent prismatic concretions, and crystallized (fig. 163, 164, 172). P. F. a right rhombic prism of $111^{\circ} 30'$ and $68^{\circ} 30'$.

Fusible into a black magnetic globule.

See Part I, Div. III, Sect. 1, A (Gr. II).

WOLFRAM. TUNGSTATE OF IRON AND MANGANESE.

Wolfram, *Beud.*, &c.; Tungstate of Iron, *Phil.*; Prismatic Scheelium Ore, *M.*; Eisen-Scheel.

H.=5·0—5·5; Sp. gr. 7·1—7·4; C. black, brownish-black; Sk. dark-brown; brittle; opaque; L. metallic, semi-metallic. It occurs massive, in prismatic and lamellar concretions, and crystallized (fig. 210, &c.) P. F. an oblique rectangular prism (?). Inclination of the base to the axis $117^{\circ} 22'$.

Decrepitates before the blow-pipe, and then fuses into a scoriaceous grey metallic globule, which often attracts the magnet.† With soda, on the platinum wire, it gives the reaction of manganese, and that of ferruginous tungstic acid with microcosmic salt. (See Chapter I.)

C. P. Tungstic acid 78·775, protoxide of iron 18·320, protoxide of manganese 6·220, silica 1·250, *Berz.*

P. L. Cornwall, Saxony, and Bohemia, in tin veins. Also Limoges, &c., in France, Sweden, Siberia, Greenland, America, in primitive rocks. In Cornwall and Saxony this substance occurs also in pseudomorphic octahedral crystals, derived from the Scheelite or Tungstate of Lime.

ANHYDRO-FERRITE.

(Red Iron Ore.)

Sk. brownish-red; Sp. gr. 3·5—5·3.

* See Crichtonite (Appendix), Sec. 2, B.

† This globule sometimes attracts the magnet very strongly, but at other times has scarcely any action upon it; the Wolfram will, therefore, be mentioned again in Section 3, A. The crystallized varieties appear to give the least attractive globules.

Fusible, without difficulty, on the edges, if the assay be in the form of a thin splinter.

See B, of this Section.

HYDRO-FERRITE.

(Brown Iron Ore.)

Sk. yellowish brown ; Sp. gr. 3.35—4.1.

Fusible, without difficulty, on the edges, if the assay be in the form of a thin splinter.

See B, of this Section.

SECTION 2.

B.

AIMANTINE.

Aimant, *Beud.*; Oxydulated Iron, *Phil.*; Octahedral Iron Ore, *M.*; Magnetstein, *W.*; Magnetic Iron Ore.

H.=5.5—6.5 ; Sp. gr. 4.75—5.2 ; C. iron-black ; Sk. black ; magnetic with polarity ; L. metallic and semi-metallic. It occurs massive, disseminated, and crystallized (fig. 8, 9, 10, 12, 23, 29, 33). P. F. the regular octahedron.

Before the blow-pipe a small crystal, in a well-sustained blast, becomes slightly rounded on its sharp angles, but it does not fuse. With the fluxes it behaves like oxide of iron.

C. P. Oxygen 28.215, iron 71.785 ; forming peroxide of iron 69, protoxide of iron 31, *Berz.*

P. L. Arendal, &c., in Norway ; Dannemora, Nordmarken, Gellivara, the Taberg Mountain, &c., in Sweden ; Siberia ; Hungary ; Hindostan, &c., forming large beds and masses in primitive rocks. Also Traversella in Piedmont ; Corsica ; and Greiner in the Tyrol, in chlorite slate ; Cornwall, the Island of Unst, in serpentine ; and Auvergne in France, and Vesuvius, in trachytic or volcanic debris.

ANHYDRO-FERRITE.

Oligiste, *Beud.* ; Specular Iron and Red Hæmatite, *Phil.* ; Rhombohedral Iron Ore, *M.* ; Red Iron Ore ; Iron Glance.

H.=5.5—6.5 in the specular varieties, and those possessing metallic lustre, the other varieties are often very soft and pass into friable ; Sp. gr. 3.5—5.3 ; C. dark steel-grey, passing into iron-black, red, bluish-red ; Sk. brownish or purplish-red ; affects the magnet slightly in some varieties ; brittle ; L. metallic, semi-metallic, earthy. It occurs massive, reniform, &c. (see the varieties), and crystallized (fig. 64, 66, 71, 123, 125, 138). P. F. a rhombohedron of 86° 10' and 93° 50'.

Fusible, without difficulty, on the edges, if the assay be in the form of a thin scale or splinter, but it is otherwise infusible *per se*, or, according to Beudant, fusible only with great difficulty.* With the fluxes, its comportment resembles that of the last species.

C. P. Oxygen 30.66, iron 69.34, of the purest varieties.

* This substance, as well as the following species, has been hitherto, I believe, in all mineralogical works in this language, said to be unalterable alone before the blow-pipe, but with what truth any one may immediately convince himself, by holding a thin fragment in the platinum forceps and directing for a few seconds the flame of a common candle upon it.

Var. and P. L.

SPECULAR IRON, OR IRON GLANCE.

C. dark steel-grey; L. metallic; massive, and crystallized as above. It occurs chiefly in Elba, the crystals from which locality have frequently a beautiful superficial tarnish; also in Siberia, Saxony, Norway, Sweden, Cornwall, &c., in primitive and transition rocks.

MICACEOUS IRON GLANCE.

A sub-variety of the above.

C. steel-grey, or iron-black; L. metallic; occurring in straight or curved thin lamellar concretions, which are very easily frangible, and translucent on the edges, presenting a blood-red colour. It is found at the same localities as the specular variety, and in the volcanic district of Auvergne.

FIBROUS IRON GLANCE, OR RED HÆMATITE.

C. red, often with a bluish tinge; L. metallic and semi-metallic; in botryoidal masses composed of fibrous and concentric-lamellar concretions. It occurs in Saxony, Bohemia, Silesia, &c., and at Ulverstone, in Lancashire.

COMPACT RED IRON ORE.

C. red; L. semi-metallic, often not very perceptible; in amorphous masses possessing a slaty structure. It occurs in Eibenstock in Saxony, in Bohemia, and in various other countries.

SCALY RED IRON ORE.

C. red, or brownish; L. often semi-metallic; in loosely cohering scaly particles, which soil the fingers.* It occurs in Saxony, Bohemia, the Brazils, &c.

OCHREOUS RED IRON ORE, OR REDDLE.

C. red; in compact, earthy-looking masses, which soil and write. It occurs in Elba, Saxony, and other places.

HYDRO-FERRITE.

Limonite, *Beud.*; Hydrous Oxide of Iron, and Brown Hæmatite, *Phil.*; Prismatic Iron Ore, *M.*; Brown Iron Ore; Limonit, *Rasen Eisenstein*, &c.

H.=5.0—5.5 in the purest varieties, the other varieties being very soft and often friable; Sp. gr. 3.35—4.1; C. brown, blackish-brown, yellow, sometimes with a variegated tarnish; Sk. yellowish-brown, yellow; L. metallic, semi-metallic, earthy. It occurs massive, &c. (see the varieties), and crystallized (fig. 195, 199, ?). P. F. a right rectangular prism.

Before the blow-pipe alone, and with the fluxes, its comportment resembles that of the last species.

C. P. Peroxide of iron 82.0, oxide of manganese 2.0, water 14.0, silica 1.0, *D'Aubuisson*.

Var. and P. L.

CRYSTALLIZED BROWN IRON ORE.

C. brownish-black, black externally; L. adamantine, semi-metallic; in small brilliant crystals (see above). It occurs at Clifton near Bristol, with quartz, in sandstone; in Cornwall, Siberia, &c.

Note.—This variety must not be confounded with the cubical and octahedral pseudomorphic crystals of this substance, derived from iron pyrites, and known by the name of *Hepatic Pyrites*. (See the note to Iron Pyrites, Sect. 2, A, Group I.)

* This variety usually contains three or four per cent. of oxide of manganese, the reaction of which metal it gives with soda on the platinum wire.

FIBROUS BROWN IRON ORE, OR BROWN HÆMATITE.

C. brown, dark, or pale; L. metallic, semi-metallic, sometimes adamantine; in botryoidal and tuberos masses composed of fibrous and concentric lamellar concretions. It occurs in Cornwall, Scotland, Saxony, Bohemia, &c., in primitive and transition, but chiefly in secondary, rocks.*

COMPACT BROWN IRON ORE.

C. dark-brown, often with a variegated tarnish; L. semi-metallic, metallic; in amorphous masses, sometimes cellular. It occurs principally with the above.

OCHREOUS BROWN IRON ORE.

C. yellow, brownish-yellow; in earthy-looking amorphous masses, which soil strongly and write. It occurs at Shotover hill, Oxfordshire; in Cornwall; Elba; Saxony, &c. The substance termed *Umber*, and which is a mechanical mixture, is closely allied to this variety. (See Part I, Div. II, Sect. 4).

BOG IRON ORE.

C. brown; soft, often friable; L. inclining to semi-metallic; in amorphous, globular, tuberos, and vesicular masses. It occurs in marshes and peat-bogs, in Scotland, Silesia, Livonia, &c., and is generally considered to be deposited by waters that have flowed over decomposed ferruginous strata, but of late years *Ehrenbergh*, the Prussian Naturalist, has reported it to be composed of the shields of infusoria.†

Appendix.

GOETHITE.

Rubin-glimmer, *Haus*.

C. brownish-red; Sk. orange-yellow; in very thin lamellar concretions, or minute tables, presenting a bright-red colour by transmitted light; L. adamantine-metallic.

C. P. Peroxide of iron 88·00, oxide of manganese 0·50, water 10·75, silica 0·50, *Brandes*.

P. L. Hollertersug in the Westerwald, Germany. A specimen from England was also analysed by Beudant, which presented an analogous composition.

FRANKLINITE.

Id. Beud., Phil., Berthier; Dodecahedral Iron Ore, *M*.

H.=6·0—6·5; Sp. gr. 5·0—5·1; C. iron-black; Sk. dark-brown; brittle; affects the magnet more or less, but does not (like the *aimantine*) possess polarity; L. semi-metallic, metallic. It occurs massive, in granular concretions, and crystallized (fig. 8), but the crystals are generally rough and irregular. P. F. the regular octahedron.

Infusible *per se*, unless it be in an extremely thin splinter, in which case it melts on the edges into a black globule. With soda on the platinum wire it gives the reaction of manganese in an intense degree.

C. P. Peroxide of iron 66, red oxide (deutoxide?) of manganese 16, oxide of zinc 17, *Berthier*.

P. L. Franklin, New Jersey, U. S., with spartalite, &c.; Altenberg, near Aix-la-Chapelle.

CHROMOFERRITE.

Eisenchrome, *Beud.*; Chromate of Iron, *Phil.*; Octahedral Chrome Ore, *M.*; Chromeisenstein, *W.*; Chromiron Ore, *Th.*

* The *Stilpnosiderite* may be referred to this or to the following variety.

† See Dr Mantell's 'Wonders of Geology,' vol. ii, p. 660, and the 'Elementary Geology,' of Professor Hitchcock, of Amherst, Mass. U. S.

H.=5.5; Sp. gr. 4.3—4.6; C. iron-black, sometimes with a tinge of brown; Sk. blackish-brown; opaque; brittle; L. semi-metallic, metallic. It occurs massive, disseminated, in granular concretions, and crystallized (fig. 8). P. F. the regular octahedron.

Infusible *per se*, but attracts the magnet after exposure to the blow-pipe. Slowly soluble in borax, imparting to the glass a fine green colour.

C. P. Green oxide of chromium 52.95, peroxide of iron 29.24, alumina 12.22, water 0.70, *Thomson*.

P. L. Styria (the Gulsen Mountains, near Kraubat); Siberia (the Uralian Mountains); Portsoy, in Banffshire; the Shetland Isles; France (Département du Var); Baltimore (the Bare Hills) and New Jersey, U. S., chiefly in veins and imbedded masses, in serpentine, and secondary trap rocks.

CRICHTONITE.

Id. Beud., Phil., &c.; Fer Oxidulé Titané.

H.=4.5; Sp. gr. 4.0; C. violet-black; Sk. black; opaque; L. 4, metallic, semi-metallic. It occurs in small crystals (fig. 73 (?) 73 a). P. F. an acute rhombohedron of $61^{\circ} 20'$ and $118^{\circ} 45'$.

Infusible *per se*, but attracts the magnet after exposure to the blow-pipe. With microcosmic salt it gives the reaction of ferruginous oxide of titanium.

C. P. Titanic acid, protoxide of iron. It has not been regularly analysed.

L. St Christophe, Oisans in Dauphiné, with rock-crystal, anatase, chlorite, albite, and other minerals, in primitive rocks.

Appendix.

MOHSITE (Levy).

H. about 5.5; C. iron-black; L. metallic; in small flat twin crystals, derived from a rhombohedron of $73^{\circ} 45'$. No perceptible cleavage.

It was observed by Mr Levy on a group of quartz crystals, believed to have been brought from Dauphiné.

TITANIO-FERRITE.

Including Nigrine, Menaccanite, Iserine, and Ilmenite.

H.=6.0, or 6.5; Sp. gr. 3.26—4.89; Sk. greyish-black, or brown; C. black; L. inclining to metallic. In small pebbles or crystalline grains, which generally attract the magnet.

See Part I, Div. III, Sect. 1, B (Group I).

SECTION 3.

A.

NATIVE ANTIMONY.

H.=3.0—3.5; Sp. gr. 6.5—6.8; C. tin-white; brittle, inclining to sectile; L. metallic.

Fusible, and entirely volatilizable before the blow-pipe.

See Div. I, Sect. 3 (Group II).

DISCRASE. ANTIMONIURET OF SILVER.

Id. (Δυσσυχρσις, bad alloy) Beud.; Antimonial Silver, *Phil.*; Prismatic Antimony, *M*; Speisglas-Silber, *W.*; Stibiuret of Silver.

H.=3.5 ; Sp. gr. 9.0—10.0 ; C. between silver and tin-white, generally with a yellow tarnish ; shining in the Sk. ; powder, black ; sectile ; L. metallic. It occurs massive, and in irregular six-sided prisms, with convex and longitudinally striated lateral planes. P. F. an obtuse rhomboid of $109^{\circ} 28'$ and $70^{\circ} 32'$, according to Necker.

Before the blow-pipe it fuses easily into a brittle grey globule, and yields finally, on continuing the heat, a malleable globule of silver.

C. P. Antimony 23, silver 77, *Klapr.*

P. L. Andreasberg, in the Hartz ; Wittichen and St Wenzel, near Wolfach, in Baden ; Allemont, in Dauphiné ; Spain, &c., in silver veins, in primitive and transition rocks, but it is a rare species.

ARSENIURET OF SILVER.

Arséniure d'Argent, *Beud.* ; Arsenical Antimonial Silver, *Phil.* ; Arsenical Silver, *Allan.*

H.=4.0 (3.5—4.0) ; Sp. gr. 8.11 (9.4 Allan) ; C. silver-white, but generally tarnished black ; brittle, inclining to sectile ; L. metallic. It occurs in small mamillated masses.

Fusible, and partly volatilizable with arsenical fumes, leaving a small bead of silver, surrounded by a scoria, which attracts the magnet.

C. P. Arsenic 35.00, antimony 4.00, iron 44.25, silver 12.75, *Klapr.*

P. L. Andreasberg, in the Hartz, &c., with the preceding species.

Note.—Very little is known concerning the correct proportions of this substance, a specimen from the same locality (Andreasberg), analysed by Duménil, under the name of Arsenic-Silber, yielded the following results : arsenic 59.94, sulphur 5.75, iron 20.25, silver 14.06. (See Beudant's 'Min.' t. 11, p. 454.)

NATIVE ARSENIC.

Id. Phil., Beud., &c. ; Rhombohedral Arsenic, *M.* ; Gediegen Arsenic, *W.*

H.=3.5 ; Sp. gr. 5.7—5.93 ; C. tin-white, on the fresh fracture, but it quickly acquires a black tarnish ; Sk. black ; brittle ; L. metallic ; when struck it emits an alliaceous odour. It occurs in amorphous and reniform masses, in plates, &c. P. F. a rhomb of $114^{\circ} 26'$ and $65^{\circ} 34'$ (?).

Fusible, and (if pure) entirely volatilizable, with copious arsenical fumes.

C. P. Arsenic, usually mixed with small portions of antimony, cobalt, iron, &c.

P. L. Joachimsthal, in Bohemia ; Freyberg, &c., in Saxony ; Allemont, in Dauphiné ; Andreasberg, in the Hartz ; Siberia ; the Bannat ; Transylvania, &c., in small quantities, in veins with Argyrose, Smaltine, Nickeline, Argyrithrose, Realgar, Zinc-blende, and other minerals, chiefly in primitive rocks.

NICKELINE. ARSENIURET OF NICKEL.

Nickeline, *Beud.* ; Arsenical Nickel, *Phil.* ; Prismatic Nickel Pyrites, *M.* ; Copper Nickel.

H.=5.0—5.5 ; Sp. gr. 6.6—7.7 ; C. copper-red, generally with a grey or blackish tarnish externally ; Sk. brownish-black ; brittle ; L. metallic. It occurs massive, disseminated, in granular concretions, reticulated, botryoidal, &c.

Easily fusible, with copious arsenical fumes, into a white or yel-

lowish globule, which tarnishes upon cooling. This globule is brittle, and not magnetic, but it becomes so, if previously well roasted, and then fused with soda.

In nitric acid it is partly soluble, becoming surrounded, in a few minutes, with a greenish coating. The solution assumes a violet colour on the addition of ammonia.

C. P. Arsenic 54·726, nickel 44·206 (iron 0·337, sulphur 0·401, lead 0·320), *Strom.*

P. L. Freyberg, Schneeberg, &c., in Saxony; Riegelsdorf in Hessa; Allemont in Dauphiné; Bohemia; the Bannat; the Hartz; Cornwall; Scotland, &c., in primitive and transition rocks, chiefly with the Smaltine. It occurs also in small quantities in Scotland, in secondary rocks (the coal-field of West Lothian: Jameson).

DISOMOSE. ARSENIO-SULPHURET OF NICKEL.

Id. (Δ is $\sigma\mu\sigma\iota\sigma$, twice resembling),* *Beud.*; Sulpho-Arsenide of Nickel, *Thomson*; Nickel-glanz.

H.=5·0—5·5; Sp. gr. 6·1—6·5; C. pale steel-grey, passing into tin-white; Sk. greyish-black; brittle; L. metallic. It occurs in small masses, composed of granular concretions.

Decrepitates before the blow-pipe, and melts, with arsenical fumes, into a brittle globule.

Partly soluble in nitric acid, forming a green solution, which changes to a violet colour on the addition of ammonia.

C. P. Sulphur 16·42, arsenic 50·56, nickel 28·98, iron 4·00. The mean of four analyses by *Berzelius*, as given by *Dr Thomson*.†

L. Loos mine, Helsingland, Sweden, accompanying ores of cobalt. It is very scarce, at least as specimens in this country.

HARTMANNITE. ANTIMONIO-SULPHURET OF NICKEL.

Antimon-Nickel, *Beud.*; Antimonial Nickel, *Phil.*; Eutomous Cobalt Pyrites, *M.*; Hartmannite; Nickelspeisglaserz.

H.=4·5—5·5; Sp. gr. 6·4—6·5; C. pale steel-grey, sometimes inclining to tin-white, and often tarnished black; Sk. greyish-black; brittle; L. metallic. It occurs massive, in granular and granulo-lamellar concretions, and occasionally crystallized (fig. 23, &c.) P. F. the cube.

Fusible with antimonial, and sometimes also with arsenical, fumes, into a brittle globule. This globule generally imparts a blue colour to glass of borax, from a slight admixture of cobalt, and forms, in nitric acid, a green solution,‡ which becomes violet on the addition of a considerable portion of ammonia.

C. P. Sulphur 15·98, antimony 55·76, nickel 27·36, *Rose.*

L. The vicinity of Freusberg in Nassausiegen in the Westerwald, in veins in transition rocks, with cobaltine, galena, copper pyrites, iron pyrites, fahl-ore, &c., but it is not a common mineral.

ZINKENITE.

H.=3·0—3·5; Sp. gr. 5·3—5·35; C. pale steel-grey; in small

* In allusion to its constituting a species of the same chemical formula as the Cobaltine and Hartmannite: the cobalt of the former replacing the nickel of the present substance, and the antimony of the latter replacing its arsenic.

† 'System of Chemistry' (7th edit.), part 3, vol. i, p. 529.

‡ If any antimony be remaining in the globule, it will be immediately precipitated in the form of a white powder.

fibrous concretions, and in six-sided prisms, longitudinally striated, and terminated at each extremity by a flat six-sided pyramid.

Decrepitates. Easily fusible.

See Div. I, Sect. 3 (Group IV).

STROMEYERINE. SULPHURET OF SILVER AND COPPER.

H.=3·0—4·0; Sp. gr. 6·2—6·3; C. steel-grey; Sk. black; very easily frangible. It occurs in small compact masses.

Easily fusible. Giving, with borax, the reactions of copper.

See Div. I, Sect. 3 (Group III).

STANNINE. SULPHURET OF TIN AND COPPER.

Id. Beud.; Sulphuret of Tin, *Phil.*; Hexahedral Copper Glance, *M.*; Zinnkies, *W.*; Tin Pyrites.

H.=3·5—4·0; Sp. gr. 4·3—4·78; C. yellowish steel-grey, frequently with a greenish tinge, and sometimes inclining to pale brass-yellow; Sk. black; brittle; L. metallic. It occurs massive, and occasionally crystallized (fig. 20). P.F. the cube. (?)

Before the blow-pipe it becomes, by roasting, covered over with a white powder (oxide of tin), which it likewise deposits on the charcoal, and then melts easily into a dark globule, which gives, with borax, the reactions of copper.

Note.—The Stromeyerine is the only other mineral included in this sub-section, which gives, with borax, the decided reactions of copper, and from that mineral the stannine may be easily distinguished by its Sp. gr. alone.

C. P. Sulphur 25, tin 34, copper 36, iron 2, *Klapr.*

L. St Agnes in Cornwall, with copper pyrites, zinc-blende, mispickel, and other minerals.

WOLFRAM. TUNGSTATE OF IRON AND MANGANESE.

H.=5·0—5·5; Sp. gr. 7·1—7·4; C. brownish-black; Sk. dark-brown; L. metallic.

Before the blow-pipe it decrepitates, and melts into a brittle and scoriaceous globule, which sometimes does, and sometimes does not, attract the magnet. With soda, on the platinum wire, it gives indications of manganese.

See Section 2, A, of this Division.

OPSIMOSE.

H. about 5·5; C. black, with sometimes a semi-metallic lustre; Sk. brown, brownish-yellow.

Fusible with bubbling. Giving the reactions of manganese, with soda, on the platinum wire.

See Part I, Div. III, Sect. 1, A (Appendix to the *Rhodonite*).

MARCELLINE.

H. about 5·0; Sp. gr. 3·8; C. greyish-black; L. inclining to semi-metallic.

Fusible *per se*. Giving, with soda, the reaction of manganese.

See as above.

SECTION 3.

B.

HAUSMANNITE.

Id. Beud., Phil., &c.; Pyramidal Manganese Ore, *M.*; Schwarzer Braunstein, *W.*; Black Manganese.

H.=5.0—5.5; Sp. gr. 4.7—4.8 (4.722 Beud.); C. brownish-black; Sk. dark-brown; brittle; opaque; L. imperfectly metallic, and feeble. It occurs massive, globular, &c., and crystallized in double four-sided pyramids, possessing a square common base, and measuring laterally $105^{\circ} 45'$, and longitudinally (or across the base) $117^{\circ} 30'.$ *

Infusible, or fusible only on the edges *per se*. Giving, with soda, on the platinum wire, the deep-green colour indicative of manganese.

C. P. Red oxide of manganese 98.098, oxygen 0.215, baryta 0.111, water 0.435, silica 0.337, *Turner*.

P. L. Ihlefeld in the Hartz; Framont in Alsatia; near Ilmenau in Thuringia; Pennsylvania, &c., but it is rather scarce. Langeberg, near Schwarzenberg, in Saxony, is also said to be a locality of this species.

BRAUNITE.

Id. Beud., Phil., &c.; Brachytypous Manganese Ore, *M.*

H.=6.0—6.5; Sp. gr. 4.8—4.9 (4.818 Beud.); C. dark brownish-black; Sk. black, with a slight tinge of brown; brittle; L. imperfectly metallic. It occurs massive, in fibrous concretions, and crystallized in double four-sided pyramids, with a square common base, differing little from the regular octahedron, and measuring laterally $109^{\circ} 53'$, and longitudinally $108^{\circ} 39'$. It also occurs in an earthy state.

Infusible *per se*. Giving with soda, on the platinum wire, the deep-green colour indicative of manganese.

C. P. Deutoxide of manganese 96.791, baryta 2.260, water 0.949, *Beud.*, from the analysis by *Turner*.

P. L. Ehrenstock, near Ilmenau, Elgersburg, &c., in Thuringia; Leimbach, Mansfeld; St Marcel, Piedmont.

MANGANITE.

Id. Haid.; Acerdese, *Beud.*; Grey Oxide of Manganese, *Phil.*; Prismatoidal Manganese Ore, *M.*; Grau Braunsteinerz, *W.*

H.=3.5—4.5; Sp. gr. 4.3—4.4; C. steel-grey, sometimes inclining to iron-black; Sk. reddish-brown; brittle; L. metallic. It occurs massive, in granular and fibrous concretions, and crystallized (fig. 168, 172, 200 a). P. F. a right rhombic prism of about 100° and 80° ($99^{\circ} 41'$ and $80^{\circ} 19'$, Necker and Beudant).

Infusible *per se*. Imparting to soda, on the platinum wire, the green colour indicative of manganese, and giving off water in the matrass.

C. P. Red oxide of manganese 86.85, oxygen 3.05,† water 10.10, *Turner*.

* The letters in the figure given in the fourth edition of 'Phillips's Mineralogy' have evidently been misplaced.

† Forming deutoxide of manganese 89.90, *Beud.*

P. L. Ihlefeld in the Hartz; Saxony, Bohemia, Norway, Sweden, Cornwall, Scotland, &c., &c.; chiefly in primitive rocks, but it also occurs in the transition and lower secondary strata.

Appendix.

WAD.

Composed of small glimmering scaly particles, or in an earthy state. C. black, blackish-brown; Sp. gr. 3·7; soils and writes.

Giving off water in the matrass, and imparting to the fluxes the tints indicative of manganese.

It occurs in the manganese pits of Devonshire, in Cornwall, Piedmont, &c.

NEWKIRKITE.

H.=3·0—3·5; Sp. gr. 3·854; C. black; rather sectile; L. splendent, metallic.

It occurs in small needles, which appear to have the form of a right square prism.

C. P. Binocide of manganese 56·30, peroxide of iron 40·35, water 6·70, *Muir*.

L. Newkirchen in Alsace, where it forms a coating on red hematite.

Note.—The above is taken from the description of this substance by Dr Thomas Thomson, by whom it was distinguished and named.

PSILOMELANE.

Id. Beud., Phil., &c.; Uncleavable Manganese Ore, *M.*; Schwartz-Braunstein; Black Hematite of the older Mineralogists.

H.=5·0—6·0; Sp. gr. 4·0—4·2; C. black, dark steel-grey; Sk. brownish-black; brittle; L. metallic, and imperfectly metallic.

It occurs massive, botryoidal, and in fibrous concretions. No observable cleavage.

Before the blow-pipe it behaves like the manganite, but fuses with great effervescence in glass of borax, resembling in this respect the Pyrolusite.

C. P. Red oxide of manganese 69·795, oxygen 7·364,* baryta 16·365, water 6·216, silica 0·260, *Turner*.

P. L. Ihlefeld in the Hartz; Siegen in Hessia; Bayreuth; Saxony; Devonshire; Cornwall, &c.; frequently associated with the Pyrolusite.

ALABANDINE. SULPHURET OF MANGANESE.

Alabandine, *Beud.*; Sulphuret of Manganese, *Phil.*; Hexahedral Glance Blende, *M.*; Mangan Blende; Schwartzertz; Alabandina Sulphurea.

H.=3·5—4·0; Sp. gr. 3·9—4·1; C. blackish steel-grey, tarnishing brownish-black; Sk. dark-green, or dark greenish-grey; brittle, inclining to sectile; L. metallic, and imperfectly metallic. It occurs massive, in granular concretions, botryoidal and crystallized in cubes (or in short square prisms) with rough surfaces, parallel to which it cleaves.

Infusible *per se*, or fusible only on the extreme edges; giving with soda on the platinum wire the reaction of manganese, and also (if it have not been previously roasted) the peculiar odour and taste, when moistened, characteristic of the presence of sulphur.

C. P. Sulphur 33·65, manganese 66·35, *Beud.*, from the analysis by *Vauq.*

P. L. Nagyag in Transylvania, with tellurium, carbonate of manganese, copper pyrites, &c.; also Peru.

URANATEMNITE.†

Pechurane, *Beud.*; Pitch-Blende, *Phil.*; Uncleavable Uranium Ore, *M.*; Pechertz, *W.*

* Forming Deutoxide of manganese 25·290, peroxide of manganese 51·870, *Beud.*

† From α τεμνω, in allusion to its want of cleavage.

H.=5.5; Sp. gr. 6.4—6.6 (generally from 6.45 to 6.5); C. black, greyish-black, brownish-black; Sk. black; brittle; opaque; L. semi-metallic. It occurs in amorphous and reniform masses. Cleavage, not observable.

Infusible *per se*. With the fluxes it gives the reactions of oxide of uranium (see Chapter I), but it also often presents indications of copper, lead, &c., from admixtures of copper pyrites, galena, and other minerals.

C. P. Protoxide of uranium 86.5 (oxide of iron 2.5, sulphuret of lead 6.0, silica 5.0), *Klapr.*

P. L. Joachimsthal, &c., in Bohemia; Schneeberg, Marienberg, Annaberg, &c., in Saxony; Rezbanya in Hungary; chiefly with native silver, argyrythrose, galena, copper pyrites, iron pyrites, and other minerals, in veins in primitive rocks; also Cornwall, in tin and copper veins, with the chalkolite.

OSM-IRIDIUM.

Iridosmine, *Beud.*, *Necker.*; Alloy of Iridium and Osmium, *Phil.*; Rhombohedral Iridium, *M.*; Osm-Iridium.

H. about 5.0; Sp. gr. 18.6—21.2; C. pale steel-grey, inclining to tin-white; brittle; L. metallic. It occurs in small flattened grains, and occasionally in six-sided prisms.

Infusible. Insoluble in acids.

C. P. Osmium	.	49.34	.	74.9	.	80
Iridium	.	46.77	.	25.1	.	20
Rhodium	.	3.15	.	.	.	.
Iron	.	0.74	.	.	.	.
		<i>Berz.</i>		<i>Id.</i>		<i>Id.</i>

P. L. Choco in South America, and the Ural Mountains, Siberia, in arenaceous deposits, with native platinum.

Note.—A native iridium is said to occur in Siberia with the above. Sp. gr. 23.55.

YTTRIO-COLUMBITE.

H.=4.5—5.5; Sk. white or grey; L. in the black varieties (Sp. gr. 5.3—5.5), semi-metallic.

Infusible *per se*. Forming, with borax, a glass which becomes milky by flaming.

See Part I, Div. II, Sect. 7, A (Group I).

COLUMBITE.

H.=6.0 (5.5—6.0); Sp. gr. 6.0—8.0; C. black; Sk. brownish-black; L. imperfect metallic.

Infusible *per se*. Giving with soda, on the platinum wire, the reaction of manganese, and forming, with borax, a green glass, which becomes milky by flaming.

See Part I, Div. III, Sect. 1, B (Group I).

ANATASE.

H.=5.5—6.0; Sp. gr. 3.8—3.9; C. brown, blue; Sk. white; L. adamantine, inclining to semi-metallic. P. F. an acute octahedron with square base.

Infusible *per se*. Giving with the fluxes the reactions of oxide of titanium.

See Part I, Div. III, Sect. 1, B (Group I).



RUTILE.

H.=6·0—6·5 ; Sp. gr. 4·2—4·3 ; Sk. pale brown ; L. metallic-adamantine. P. F. a right square prism.

Infusible *per se*. Giving with the fluxes the reactions of oxide of titanium.

See Part I, Div. III, Sect. 1, B (Group I).

BROOKITE.

H.=5·5—6·0 ; Sk. yellowish-white ; L. metallic-adamantine. P. F. a right rhombic prism of 100° and 80°.

Infusible *per se*. Giving with the fluxes the reactions of oxide of titanium.

See Part I, Div. III, Sect. 1, B (Group I).

POLYMIGNITE.

H.=6·5 ; Sp. gr. 4·77—4·85 ; C. black ; Sk. dark-brown ; L. brilliant, semi-metallic. In thin lengthened crystals, striated longitudinally.

Infusible *per se*. Giving with the fluxes the reactions of oxide of titanium, &c.

See Part I, Div. III, Sect. 1, B (Group I).

ANTHOPHYLLITE.

H.=5·0—5·5 ; Sp. gr. 3·0—3·3 ; Sk. white ; L. metallic-pearly.

See Part I, Div. II, Sect. 7, A (Group II).

BRONZITE.

H.=4·0—4·5 ; Sp. gr. 3·0—3·3 ; Sk. white ; L. metallic-pearly.

See as above.

GENERAL APPENDIX.

BEUDANTITE (LEVY).

H.=4·0—4·5 ; C. black in the mass, but deep-brown by transmitted light, when in thin fragments ; Sk. greenish-grey ; L. resinous. It occurs in small aggregated and slightly obtuse rhomboids of 92° 30', and 87° 30', with truncated summits.

C. P. The oxides of lead and iron, *Wollaston*.

L. Horhausen, district of Nassau, on the Rhine, where it occurs with brown iron ore.

BREISLAKITE.

In delicate filamentous or capillary crystals, of a brown colour, and semi-metallic lustre.

Fusible into a black magnetic scoria, and giving with the fluxes the reactions of iron and copper (Allan).

L. Vesuvius, and Capo di Bove near Rome, in the cavities of lava.

CHONIKRITE (KOBELL).

H.=2·0—4·0 ; C. greyish, or yellowish-white, with feeble lustre.

It occurs in rounded masses ; structure, not observable.

Fusible, *per se*, into a greyish glass.

C. P. Silica 35·69, alumina 17·12, magnesia 22·50, lime 12·00, protoxide of iron 1·46, water 9·00, *Kobell*.

L. Elba.

CRUCITE (THOMPSON).

H.=3·0 ; Sp. gr. 3·579—3·8095 ; C. black internally, red externally ; dull ; opaque. It occurs in twin crystals, composed of two or of three oblique four-sided prisms crossing each other at an angle of 60°.

Before the blow-pipe it acts like oxide of iron.

C. P. Peroxide of iron 81·666, alumina 6·866, silica and scales of mica 6·000, lime 4·000, magnesia 0·532, *R. Thompson*. It was impossible to exclude all the matrix.

L. Clonmell, county of Waterford, Ireland, where it occurs in clay slate.

Note.—In the description of this substance by Dr Thomas Thompson, from which the above is taken, the colour of the streak is not mentioned, and as I was unable to procure any specimens, I could not insert it in the body of the work. Probably, however, the Sk. is brownish-red, in which case it would belong to Part I, Division II, Section 7, B, with a reference to Section 6, B, as oxide of iron fuses, when in a thin splinter, on the edges. The reader will therefore, perhaps, have the kindness to make a marginal note referring to the present page, at those places.

ERLANITE (BREITHAUP).

H.=5·0 (6·25—7·0, Thomson) ; Sp. gr. 3·0—3·1 ; C. greenish-grey, shining and resinous in the Sk. ; feeble lustre. It occurs massive. Easily fusible into a greyish glass.

C. P. Silica 53·16, alumina 14·03, lime 14·39, magnesia 5·42, soda 2·61, peroxide of iron 7·14, oxide of manganese 0·64, volatile matter 0·60, *Gmelin*.

L. The vicinity of Erla in the Saxon Erzgebirge, in beds or large masses in the older primary rocks. It is used as a flux at the Erla Iron Works.

HERSCHELLITE (LEVY).

H.=4·5 ; Sp. gr. 2·11 ; C. white ; Fr. conchoidal. It occurs in six-sided prisms, the lateral planes being horizontally striated.

C. P. Silica, alumina, and potassa, *Wollaston*.

L. Aci Reale, near Catania, in Sicily, in trap rocks with the Phillipsite.

TEPHROITE (LEONHARD).

H.=5·5—6·0 ; Sp. gr. 4·116 ; C. grey, greyish-black ; Sk. grey ; L. adamantine. It occurs massive.

Fusible into a black slag.

L. Sparta, New Jersey, U. S., with the spartalite and franklinite.

VARVACITE (R. PHILLIPS).

H.=2·5 ; Sp. gr. 4·283—4·531 ; C. steel-grey ; L. metallic. It occurs in thin foliated and fibrous concretions.

C. P. Protoxide of manganese 81·12, oxygen 13·48, water 5·40, *R. Phillips*.

L. Warwickshire.

ZURLITE (MONTICELLI).

H. about 6·0 ; Sp. gr. 3·27 ; C. light-green, greyish ; Sk. white ; L. resinous ; opaque. It occurs in rough four-sided rectangular prisms, simple or modified.

Infusible *per se*.

L. Vesuvius.

* * For other new and little-known species, consult Dr Thomson's 'Outlines of Mineralogy,' &c. ('System of Chemistry,' Part III, Seventh Edition), and also the Appendix to the Fourth Edition of 'Phillips's Mineralogy.'

Note.—The reader is requested to add to the description of the *Mimetese* (p. 33), that the yellow crystals from Cumberland are frequently curved in a longitudinal direction, or, in a manner, barrel-shaped. I do not know the reason why modern authors, in describing the colours of this species, leave out green, as that colour is as common to it (the *Mimetese*), as it is to the *Pyromorphite* or Phosphate of Lead.

INSTRUMENTS NECESSARY FOR, OR USEFUL TO, THE STUDENT, IN THE
DISCRIMINATION OF MINERALS BY THE PRESENT WORK.

A small blow-pipe. That invented by Dr Wollaston, from its portability, is one of the most useful.

A pair of forceps with platinum tips. Those made of steel are the best.

A small quantity of platinum foil and wire.

Some well-burnt alder charcoal.

A small quantity of borax (borate of soda), of microcosmic salt (a compound of phosphoric acid, soda, and ammonia), and of sub-carbonate of soda.*

A little nitric or muriatic acid, in a small bottle with a glass stopper.

A small microscope or pocket lens.

A knife; a small hammer, and one or two fine hard files.

A small anvil, or a flat piece of hard steel, polished on all its faces.

A small agate pestle and mortar, or one of Wedgewood's ware. A small mortar of hardened steel, composed of two pieces, with a tightly-fitting pestle, is also very useful for crushing hard substances.

A magnetic needle and centre. A small electrometer is also occasionally useful; it may be supported on the same centre as the magnetic needle.

Some glass tubing of about one-eighth of an inch in diameter.

One or two small flasks or matrasses, and a few test tubes. Also one or two watch glasses. The above are best made of the green German glass.

A small spirit lamp, and one or two pieces of wire, bent at their extremities, to form supports for the flasks, &c. A very useful lamp of this description is now made on the Argand principle, having a stem with supports attached to it, by means of a screw. This lamp affords an intense heat, and, as it takes to pieces, it is exceedingly convenient in travelling.†

A dropping tube, for washing filters, and for separating the charcoal powder from the metallic grains, in reducing experiments.

* The following reagents are also occasionally wanted:—

Silica (pulverised rock-crystal).

Oxide of Copper.

Nitrate of Cobalt, dissolved in water, for detecting alumina and magnesia; imparting to the former, after ignition or fusion, a blue colour, and to the latter a reddish colour. (It also imparts a blue colour to lime, &c., but not till *after* fusion. See Berzelius 'On the Blowpipe'.)

Lead and Bone Ash, for cupelling.

Tin foil, closely rolled up, for promoting reduction when thrust into the fused vitreous compounds.

For the remaining reagents, which are rarely used, consult the above work.

† The student may, however, make a cheap spirit lamp for himself, by procuring a short phial or bottle, with a well-fitting cork, and by passing through this cork (previously perforated) a small piece of the glass tubing, described above, to serve as a neck for the cotton wick.

Some tumeric, Brazil-wood, and litmus test papers. A little filtering paper will also be found useful.

An instrument for taking specific gravities.

This instrument is much more expensive than any of the preceding ones. The best for practical purposes is the *areometer* or *Nicholson's portable balance*, which, fitted up with weights, &c., in a small case, costs from thirty to thirty-five shillings. This instrument is described in nearly all the more modern mineralogical works, but a brief and clear account of the method of using it, in taking specific gravities, may not be unacceptable in the present place.

First: place the instrument in any convenient vessel full of rain water (a common bed-room ewer for example).*

Secondly: place the weights one by one in the upper cup, until the notch on the stem, which supports it, be exactly on a level with the surface of the water, and note down the amount of weight which causes this depression (calling it A).

Thirdly: remove the weights, and place in the cup the mineral† (the Sp. gr. of which you wish to ascertain), adding the weights as before, until the notch on the stem again coincide with the surface of the water, and note down this weight (calling it B).

Fourthly: remove the weights, and place the mineral in the lower cup (beneath the water), again placing the weights in the upper cup until the notch on the stem once more coincide with the surface of the water, and note down this weight, which will be greater than the last (calling it C).

Lastly: subtract B (the second weight) both from A and from C, separately, and divide the greater remainder by the lesser, when the quotient will be the specific gravity sought.

Example, referring to a crystal of LIEVRITE, from Elba.

GRS.		GRS.
130.50 A		47.60 C
20.20 B		20.20 B
<hr/>		<hr/>
110.30		27.40
	27.40) 110.30 (4.0, &c.	
	109.60	
	<hr/>	
	700	

The Sp. gr. therefore=4.0.

Note.—The first weight (A) ought to be always the same, and may therefore be called the Balance or Standard Weight, and its amount should be scratched on the cup, or on some other part of the instrument, so as to avoid the necessity of always taking it before commencing operations.

Also, when the mineral is removed to the lower cup, the weights in the upper cup need not be taken away, but fresh ones added until the notch on the stem be sunk to the level of the water; in which case B must only be subtracted from A (the balance weight), and the amount of these newly added weights will be the divisor for the remainder of the sum, as a glance at the preceding example will show. It is, however, better perhaps to follow the first method, and to clear the cup entirely, as it lessens the chance of error.

* Distilled water of a temperature of 60° Fahr. must be used in delicate investigations, but rain water, at the common temperature, is quite sufficient for practical purposes.

† Broken into small fragments, if possible.

CHAPTER III.

A Natural Arrangement of Simple Minerals, founded on their Constituent Parts, and the Manner in which they occur in Nature.

Introductory Remarks.—As this Arrangement is founded on the Constituent Parts or Elements of Minerals, and as a certain fixed order of succession must be adopted throughout its details, the reader is first presented with a table of these Elements, arranged in the order in which they and their combinations will succeed each other throughout the chapter.

They are divided into several groups or families, derived from the methods in which they occur in Nature,

These Groups are as follows :—

1. *Native.* Pure, chemically uncombined Elements : Ex. PLATINUM.
 2. *Native, and Passively Mineralized.* Elements which occur in an uncombined state, and also combined with, or mineralized by, other elements, but without then possessing the power of mineralizing other substances : Ex. COPPER.
 3. *Passively Mineralized.* This term has already been explained : Ex. TIN, which does not occur in a native state, but passively mineralized by oxygen and by sulphur.
 4. *Actively Mineralized.* Elements which possess the power, when mineralized, of becoming semi-mineralizers, or of combining as mineralizers with other substances : Ex. SILICIUM, which does not occur in a native state, but mineralized by oxygen, forming *Silica* or *Silicic Acid*, which, combining in its turn with other substances, forms the large body of *Silicates*.
- Note.*—These semi-mineralizers have only power over mineralized substances ; thus, silica does not combine with copper, but with oxide of copper.
5. *Mineralizers.* Elements which have the power, in a pure or uncombined state, of mineralizing other elements : Ex. SULPHUR, OXYGEN.

Note.—These Elements have the power, in certain cases, of mineralizing each other, the compounds then becoming semi-mineralizers, as in the two elements given as examples above, which, when combined, form *Sulphuric Acid*, a combination forming in its turn with other substances, the large body of *Sulphates*.

A TABULAR VIEW OF THE ELEMENTARY BODIES, WITH THEIR SIGNS.

1. <i>Native.</i>				Pl. Pd. R. Os. Ir. Au.	Strontium	-	-	-	Sr.
Platinum	-	-	-		Barium	-	-	-	Ba.
Palladium	-	-	-		Sodium	-	-	-	Na.
Rhodium	-	-	-		Potassium	-	-	-	K.
Osmium	-	-	-		Lithium	-	-	-	L.
Iridium	-	-	-						
Gold	-	-	-						
2. <i>Native and Passively Mineralized.</i>				Ag. Hg. Bi. Pb. Cu. Fe.	4. <i>Actively Mineralized.</i>				
Silver	-	-	-		Titanium	-	-	-	Ti.
Mercury	-	-	-		Columbium	-	-	-	Ta.
Bismuth	-	-	-		Tungstenum	-	-	-	W.
Lead	-	-	-		Molybdenum	-	-	-	Mo.
Copper	-	-	-		Chromium	-	-	-	Cr.
Iron	-	-	-		Vanadium	-	-	-	V.
				Ni. Co. Mn. Sn. Zn. Cd. Ce. U. Th. Zr. G. Y. Mg. Ca.	Aluminium	-	-	-	Al.
					Silicium	-	-	-	Si.
					Boron	-	-	-	B.
					Phosphorus	-	-	-	P.
					5. <i>Mineralizers.</i>				
3. <i>Passively Mineralized.</i>					Antimony	-	-	-	Sb.
Nickel	-	-	-		Arsenic	-	-	-	As.
Cobalt	-	-	-	Tellurium	-	-	-	Te.	
Manganese	-	-	-	Selenium	-	-	-	Se.	
Tin	-	-	-	Sulphur	-	-	-	S.	
Zinc	-	-	-	Carbon	-	-	-	C.	
Cadmium	-	-	-	Oxygen	-	-	-	O.	
Cerium	-	-	-	Hydrogen	-	-	-	H.	
Uranium	-	-	-	Nitrogen	-	-	-	N.	
Thorinium	-	-	-	Fluorine	-	-	-	F.	
Zirconium	-	-	-	Chlorine	-	-	-	Cl.	
Glucinium	-	-	-	Iodine	-	-	-	I.	
Yttrium	-	-	-	Bromine	-	-	-	Br.	
Magnesium	-	-	-						
Calcium	-	-	-						

Note.—The above signs (given by Berzelius) are chiefly taken from the Latin names of the elements. Thus, the sign of tin (Sn.) is derived from Stannum; that of Mercury (Hg.) from Hydrargyrum; of Antimony (Sb.) from Stibium, &c. The sign of Tungstenum (W), is derived from Wolfram, the mineral in which it was first discovered, hence this element has been also termed "Wolframium."

It will be seen that the above groups are perfectly natural, and pass insensibly, as it were, into each other: the mineralizers being connected to the semi-mineralizers; these also (when in the state of simple oxides or acids), to the passively mineralized elements, some of which (those forming the second group) occur likewise in a native state, and are consequently allied to the elements which occur only so. Thus do these groups follow each other in a certain natural order,—the individual elements within each being arranged according to the similitude of their characters.

Let us now turn to the ARRANGEMENT OF MINERALS : first will come the Native Substances, and then the combinations of the various mineralizers in the order in which they are placed in the foregoing Table. The following will then represent the heads of this arrangement :—

NATIVE SUBSTANCES.

ANTIMONIURETS.

ARSENIURETS.

TELLURETS.

SELENIURETS.

SULPHURETS.

CARBURETS.

OXIDES.

TITANIATES.

COLUMBATES.

TUNGSTATES.

MOLYBDATES.

CHROMATES.

VANADIATES.

ALUMINATES.

SILICATES.

BORATES.

PHOSPHATES.

ARSENIATES.

SULPHATES.

CARBONATES.

NITRATES.

FLUORIDES.

CHLORIDES.

IODIDES (?).

BROMIDES (?).

Organico-Chemical Substances.

NOTE.

It is desirable in the following arrangement to give some just idea of the constituent parts of the various minerals, but of the two methods of doing this now in use, neither is exactly applicable in the present instance.

The first method is that which has been employed in the preceding chapter, namely : of giving the constituent elements by weight of one hundred parts of each mineral, prefixing in full the names of these elements,—and this method is inappropriate in the present place, as it takes up too much space, and does not, from its length, convey at once to the mind an accurate conception of the composition of the mineral.

The second method is that of employing formulæ according to the theory of Atomic Proportions ; but this method (although of the highest value in conveying quickly to the mind a clear and accurate

idea of the relative proportions of the combining elements) is too theoretical to be employed in the present pages, and it would also have to be assumed that the reader was perfectly acquainted with this theory, and able to read and construct at will its derived formulæ, as want of space and time would prevent me from entering into its details in a satisfactory manner.

The method which I have therefore made use of in the following arrangement of minerals, consists in reducing to twenty parts the one hundred parts usually employed in mineral analysis; and by making these (with a few exceptions) all whole numbers,* and also by omitting the foreign or accidental ingredients, and prefixing the signs instead of the full names of the combining elements, the composition, &c. of each mineral may be taken up by the eye at a single glance.

Note.—For the sake of abbreviation, whenever any element is mineralized by OXYGEN, its sign is printed in Italics: thus Cu. signifies copper, *Cu.* oxide of copper. The various degrees of oxidation are expressed also by small figures, when requisite: thus, *Fe*.¹ expresses protoxide of iron, *Mg*.² deutoxide of manganese, and *Fe*.³ peroxide of iron. Water is designated by the sign Aq. (aqua).

The mineralizing substance or element is always placed first.

A NATURAL ARRANGEMENT OF MINERALS.

Note.—The reader is humbly requested to bear in mind the two following observations:—

First,—That the proportions of the constituent parts of minerals, as given in the following arrangement, are, in most cases, only to be regarded as approximations; and secondly,—that the brief remarks prefixed to the various divisions are merely intended as a slight additional help to the student in recognising them; as, in several instances, the same characters are applicable also to some of the substances comprised in other divisions, a circumstance which is prevented or perfectly remedied in the preceding *artificial arrangement*. Those characters which are not founded on a chemical (or analytical) basis, can of course only refer to the species at present discovered.

NATIVE SUBSTANCES.

(L. metallic or not metallic. If the former, Sp. gr. over 7.4, or *entirely* volatilizable by heat. If the latter, C. yellow, or H.=10, and volatilizable by heat without any alliaceous odour.)

Platinum (Pl.).

Palladium (Pd.).

Osm-Iridium (Os. Ir.).

Gold (Au.).

Silver (Ag.).

Mercury (Hg.).

Native Amalgam (Hg. 13, Ag. 7; or Hg. 14½, Ag. 5½).

Bismuth (Bi.).

Lead (Pb.).

Copper (Cu.).

Iron (Fe.).

Antimony (Sb.).

* The mean of several analyses is often taken.

Arsenic (As.).
 Tellurium (Te.).
 Sulphur (S.).
 Carbon (C.); the Diamond.
 Hydrogen (H.).

ANTIMONIURETS.

(STIBIURETS.)

Diseraze (Sb. 4, Ag. 16).

ARSENIURETS.

(Substances possessing a metallic lustre, and emitting before the blow-pipe alliaceous fumes. Not *entirely* volatilizable.)

Arseniuret of Silver (As. 7, Sb. 1, Fe. 9, Ag. 3).

Arseniuret of Bismuth (As. Bi. ?).

Mohsine (As. 14, Fe. 6).

Nickeline (As. 11, Ni. 9).

Smaltine (As. 15, Co. 5).

TELLURETS.

(Substances possessing a metallic lustre, and yielding by roasting in the open tube, a white sublimation, capable of being fused into limpid colourless drops. Not *entirely* volatilizable.)

Sylvane (Te. 12, Au. 6, Ag. 2).

Mullerine (Te. 9, Au. 5, Pb. 4, Ag. 2).

Telluret of Silver (Te. 8, Ag. 12).

Bornine (Te. 6, S. 1, Bi. 13).

Elasmose (Te. 6, S. 1, Pb. 11, Au. &c. 2).

SELENIURETS.

(Substances possessing a metallic lustre, and which yield by roasting a strong odour of decayed horse-radish; forming also in the open tube a red sublimation.)

Seleniuret of Silver (?).

Seleniuret of Silver and Lead (Se. 19, Pb. 1).

Eukairite (Se. 5, Ag. 8, Cu. 5, earthy matters, &c. 2).

Seleniuret of Lead and Mercury (Se. 5, Hg. $3\frac{1}{2}$, Pb. $11\frac{1}{2}$; or, Se. $5\frac{1}{2}$, Hg. 9, Pb. $5\frac{1}{2}$).

Clausthalite (Se. 14, Pb. 6).

Seleniuret of Lead and Copper (Se. 6, Pb. 12, Cu. &c. 2; or Se. 7, Pb. $9\frac{1}{2}$, Cu. $3\frac{1}{2}$).

Seleniuret of Lead and Cobalt (Se. 6, Pb. 13, Co. 1).

Berzeline (Se. 8, Cu. 12).

Seleniuret of Zinc (?).

SULPHURETS.

(Substances which, when fused with carbonate of soda on charcoal, and then moistened with acidulated water, disengage the fetid odour and possess the disagreeable taste of sulphuretted hydrogen.* These substances possess also a metallic lustre, or otherwise, are (1) entirely volatilizable before the blow-pipe, (2) have a red streak, or (3) are infusible, but which im-

* See also Chapter I.

part to soda (carbonate of soda), in common with other sulphurets, a reddish or yellowish-brown colour.)

A. COMMON SULPHURETS.

- Argyrose (S. $2\frac{1}{2}$, Ag. $17\frac{1}{2}$).
- Stromeyerine (S. 3, Ag. $10\frac{1}{2}$, Cu. $6\frac{1}{2}$).
- Sternbergite (S. 7, Ag. $6\frac{1}{2}$, Fe. $6\frac{1}{2}$).
- Cinnabar (S. 3, Hg. 17).
- Bismuthine (S. 4, Bi. 16).
- Aikenite (S. 3, Bi. 8, Pb. 7, Cu. 2).
- Sulphuret of Bismuth and Copper (S. $2\frac{1}{2}$, Bi. $9\frac{1}{2}$, Cu. 7, loss 1).
- Galena (S. 3, Pb. 17).
- Super-Sulph^t. of Lead (S. $3\frac{1}{2}$, Pb. $16\frac{1}{2}$).
- Chalkosine (S. 5, Cu. 15).
- Breithauptite (S. $6\frac{1}{2}$, Cu. $13\frac{1}{2}$).
- Covelline* (S. $6\frac{1}{2}$, Cu. $13\frac{1}{2}$).
- Phillipsine (S. 5, Cu. 12, Fe. 3).
- Copper Pyrites (S. 7, Cu. $6\frac{1}{2}$, Fe. $6\frac{1}{2}$).
- Iron Pyrites (S. 11, Fe. 9).
- Radiated Iron Pyrites (S. 11, Fe. 9).
- Magnetic Iron Pyrites (S. 8, Fe. 12).
- Capillose (S. 7, Ni. 13).
- Koboldine (S. 8, Co. 9, Cu. 2, Fe. 1).
- Alabandine (S. 3, Mn. 17).
- Stannine (S. 5, Sn. 7, Cu. $7\frac{1}{2}$, Fe. $\frac{1}{2}$).
- Zinc-blende (S. 7, Zn. 12, Fe. 1).
- Molybdenite (S. 8, Mo. 12).
- Stibine (S. 5, Sb. 15).
- Realgar (S. 6, As. 14).
- Orpiment (S. $7\frac{1}{2}$, As. $12\frac{1}{2}$).
- Sulphuretted Hydrogen (S. 1, H. 19).

Note.—A sulphuret of cadmium, to which the name of "Greenockite" has been given, was found two or three years ago at Bishopstown in Renfrewshire, but not having been able to obtain a specimen, I could not insert it in the Artificial Arrangement.

B. ANTIMONIO-SULPHURETS.

- Psaturose (S. 3, Sb. 3, Ag. 14).
- Argyrythrose (S. $3\frac{1}{2}$, Sb. $4\frac{1}{2}$, Ag. 12).
- Miargyrite (S. $4\frac{1}{2}$, Sb. 8, Ag. $7\frac{1}{2}$).
- Donacargyrite (S., Sb., Ag., Cu.).
- Polybasite (S. $3\frac{1}{2}$, Sb. and As. $1\frac{1}{2}$, Ag. 13, Cu. 2).
- Zinkenite (S. $4\frac{1}{2}$, Sb. 9, Pb. $6\frac{1}{2}$).
- Jamesonite (S. $4\frac{1}{2}$, Sb. $7\frac{1}{2}$, Pb. 3).
- Plagionite (S. 4, Sb. 8, Pb. 8).
- Bournonite (S. 4, Sb. 5, Pb. 3, Cu. &c. 3).
- Fahl-Ore (see page 126).
- Berthierite (S. 6, Sb. $10\frac{1}{2}$, Fe. $3\frac{1}{2}$).
- Hartmannite (S. $3\frac{1}{2}$, Sb. 11, Ni. $5\frac{1}{2}$; or S. $3\frac{1}{2}$, Sb. 9, As. 2, Ni. $5\frac{1}{2}$).

* In black or dark greenish-blue filamentous incrustations on the fumaroles of Vesuvius: sulphur 32, copper 66, loss 2, *Covelli*.

C. ARSENIO-SULPHURETS.

- Proustite (S. 4, As. 3, Ag. 13).
 Fahl-Ore (see page 126).
 Mispickel (S. 4, As. 9, Fe. 7).
 Disomose (S. 4, As. 9, Ni. 6, Fe. 1).
 Cobaltine (S. 4, As. 9, Co. $6\frac{1}{2}$, Fe. $\frac{1}{2}$).

CARBURETS.

- Graphite (C. $18\frac{1}{4}$, Fe. $1\frac{3}{4}$).

Note.—The remaining substances of this class, being evidently of vegetable or organic origin, are arranged by themselves under the term of “Organico-Chemical Substances.”

OXIDES.

A. SIMPLE OXIDES AND ACIDS.

- Oxide of Bismuth (Ox. 2, Bi. 18).
 Minium (Ox. 2, Pb. 18).
 Ruberite (Ox. 2, Cu. 18).
 Melaconise (Ox. 4, Cu. 16).
 Aimantite (Ox. 6, Fe. 14, forming Fe^1 . 6, Fe^3 . 14).
 Anhydro-Ferrite (Ox. 6, Fe. 14).
 Hydro-Ferrite (Fe^3 . &c. 17, *Aq.* 3).
Crucite.
Beudantite.
 Oxide of Cobalt (Ox. 6, Co. 14).
 Hausmannite (Ox. $4\frac{1}{2}$, Mn. $15\frac{1}{2}$).
 Braunnite (Ox. 6, Mn. 14).
 Pyrolusite (Ox. 6, Mn. $13\frac{1}{2}$, *Aq.* $\frac{1}{2}$).
 Manganite (Ox. $4\frac{1}{2}$, Mn. $13\frac{1}{2}$, *Aq.* 2).
 Psilomelane (Ox. $4\frac{1}{2}$, Mn. 11, *Ba.* 3, *Aq.* $1\frac{1}{2}$).
Newkirkite, &c.
 Cassiterite (Ox. 4, Sn. 16).
 Spartalite (Ox. $3\frac{1}{2}$, Zn. $16\frac{1}{2}$).
 Franklinite (Fe^3 . 13, Zn. $3\frac{1}{2}$, Mn. $3\frac{1}{2}$).
 Uranatennite (Ox. $\frac{1}{2}$, U. $19\frac{1}{2}$).
 Uraconise (Ox., U., *Aq.*).
 Brucite (*Mg.* 14, *Aq.* 6).
 Rutile (Ox. $6\frac{1}{2}$, Ti. $13\frac{1}{2}$).
 Anatase (*Ti.*).
 Brookite (*Ti.*).
 Tungstic Acid (Ox. 4, W. 16).
 Molybdic Acid (Ox. $6\frac{1}{2}$, Mo. $13\frac{1}{2}$).
 Oxide of Chrome (Ox. 6, Cr. 14).
 Corundum (Ox. $9\frac{1}{2}$, Al. $10\frac{1}{2}$).
 Gibbsite (*Al.* 13, *Aq.* 7).
 Diaspore (*Al.* 16, *Fe.* 1, *Aq.* 3).
 Quartz (Ox. $10\frac{1}{2}$, Si. $9\frac{1}{2}$).
 Opal (*Si.* 18, *Aq.* 2; or *Si.* 19, *Aq.* 1).
 Exitelite (Ox. 3, Sb. 17).
 Stibiconise (*Sb.*, *Aq.*)

Kermesite (*Sb.* 6, *S.* *Sb.* 14).
 Arsenic Acid (*Ox.* 5, *As.* 15).
 Sulphuric Acid (*Ox.* 10, *S.* 10).
 Hydrous or Liquid Sulphuric Acid (*S.* 16, *Aq.* 4).
 Carbonic Acid (*Ox.* $14\frac{1}{2}$, *C.* $5\frac{1}{2}$).
 Water (*Ox.* 18, *H.* 2).
 Atmospheric Air (*Ox.* $4\frac{1}{2}$, *N.* $15\frac{1}{2}$).

B. TITANIATES.

Substances presenting with borax the marked reaction of titanitic acid (see Chapter I).

Titanio-Ferrite (*Ti.*, *Fe*¹., see page 99).
 Chrichtonite (*Ti.*, *Fe.*).
 Æschynite (*Ti.* 11, *Zr.* 4, *Ce.* 3, *Ca.*, *Fe.*, &c. 2).
 Polymignite (*Ti.* $9\frac{1}{2}$, *Zr.* 3, *Y.* $2\frac{1}{2}$, *Ce.* 1, *Fe.* $2\frac{1}{2}$, *Ca.* 1, *Mn.* $\frac{1}{2}$).
 Pyrochlore (*Ti.* $12\frac{1}{2}$, *Ca.* $2\frac{1}{2}$, *Fe.* and *Mn.* 1, *U.* 1, *Ce.* 1, *Aq.* 1).
 Sphene (*Ti.* $6\frac{1}{2}$, *Si.* 7, *Ca.* $6\frac{1}{2}$).

C. COLUMBATES (Tantalates).

Substances giving by fusion with carbonate of soda a salt soluble in water, the solution precipitating, on the addition of nitric acid, a white powder, which yields with borax a colourless glass that may be rendered opaque by flaming (Beud.). Sp. gr. 5·8—6·8.

Columbite (*Ta.* $16\frac{1}{2}$, *Fe.*, *Mn.*, &c. $3\frac{1}{2}$, or *Ta.* 15, *Fe.* 4, *Mn.* &c. 1).
 Ytthro-Columbite.

Dark (*Ta.* $10\frac{1}{2}$, *Y.* $7\frac{1}{2}$, *Ca.*, *W.*, &c. 2).

Black (*Ta.* $11\frac{1}{2}$, *Y.* 4, *Ca.*, *W.*, &c. $4\frac{1}{2}$).

Yellow (*Ta.* 12, *Y.* 5, *U.* 2, *Ca.*, *W.*, &c. 1).

Fergusonite (*Ta.* 10, *Y.* 8, *Zr.*, *Ce.*, *Sn.*, &c. 2).

D. TUNGSTATES.

Substances which, when fused with carbonate of soda, form a matter soluble in water; the solution yielding, on the addition of nitric acid, a white precipitate, becoming yellow by boiling, and which fuses, with microcosmic salt, into a blue glass (Beudant). Not pulverulent.

Scheelite (*W.* $10\frac{1}{2}$, *Pb.* $9\frac{1}{2}$).

Wolfram (*W.* $15\frac{1}{2}$, *Fe.* $3\frac{1}{2}$, *Mn.* 1).

Scheelite (*W.* 16, *Ca.* 4).

E. MOLYBDATES.

Substances which fuse with microcosmic salt in the R. F., into a green glass. Not pulverulent.

Melinose (*Mo.* 8, *Pb.* 12).

The above is the only molybdate which has hitherto been found in nature.

F. CHROMATES.

Substances which, when fused with carbonate of soda, or nitrate of soda, or of potassa, form a matter soluble in water; the solution yielding a yellow precipitate with nitrate of lead, and a red precipitate with the nitrates of silver and mercury (Beud.); see also Chapter I. If C. green, fusible,—otherwise it is chromic acid).

Crocoisite (*Cr.* 6, *Pb.* 14).

Vauquelinite (*Cr.* 6, *Pb.* 12, *Cu.* 2).

Chromoferrite (*Cr.* 11, *Fe.* 7, *Al.* 2).

G. VANADIATES.

Johnstonnite (*V. Pb.* 15, *Cl. Pb.* 5).

H. ALUMINATES.

Substances which form, with carbonate of soda, before the blow-pipe, a composition, generally infusible, and more or less soluble in acids; the solution yielding a gelatinous precipitate on the addition of ammonia, which becomes of a fine blue colour when heated with nitrate of cobalt (Beud.); H. less than 9.0, but more than 7.0, unless Sp. gr.=6.4).

Plombgomme (*Al.* 8, *Pb.* 8, *Aq.* 4).

Pleonaste (*Al.* 12, *Fe.* 4, *Mg.* 4).

Gahnite (*Al.* 12, *Zn.* 6, *Fe.* &c. 2).

Chrysoberyl (*Al.* 15½, *G.* 3½, *Fe.* 1).

Spinel (*Al.* 14, *Mg.* with *Cr.* 6).

I. SILICATES.

Substances forming (although with difficulty) by fusion with carbonate of soda a matter soluble in water; the solution yielding a white precipitate by evaporation, or on the addition of concentrated nitric or hydrochloric acid. This precipitate fuses, with carbonate of soda, into a clear glass, and does not colour the other fluxes.

Several silicates are partly soluble in acids, *per se*, forming a transparent gelatinous mass produced by the separation of the silica. All substances which gelatinize with acids are, therefore (as far as our present knowledge extends), silicates (Beud.).

Note.—The numerous minerals of this division are, for convenience, arranged in two bodies: *Non-Aluminous Silicates*, and *Aluminous Silicates*, after the method of Beudant; but they may be also farther sub-divided in the Cabinet into groups, with the following labels (which are printed in *Italics*) attached to them.

Non-aluminous Silicates containing Oxide of Bismuth.

Silicate of Bismuth (*Si.* 14, *Bi.* 4½, *Fe.* &c. &c. 1½).

Non-aluminous Silicates containing Oxide of Copper.

Chrysocolla (*Si.* 6, *Cu.* 10, *Aq.* 4).

Diopase *Si.* 7, *Cu.* 10½, *Aq.* 2½).

Non-aluminous Silicates containing Oxide of Iron.

Cronstedite (*Si.* 5, *Fe.* with *Mn.* &c. 13, *Aq.* 2).

Pinguite *Si.* 7½, *Fe.* 7½, *Aq.* 5).

Chloropal (*Si.* 9, *Fe.* &c. 7, *Aq.* 4).

Non-aluminous Silicates containing Oxide of Iron and Lime.

Ferrugino-Calcareous Garnet (*Si.* 7½, *Fe.* 5, *Ca.* 6, *Mn.* *Al.* &c. 1½).

Lievrite (*Si.* 6, *Fe.* &c. 11½, *Ca.* 2½).

Non-aluminous Silicates containing Oxide of Iron and Soda.

Krokydolite (*Si.* 10½, *Fe.* 6½, *Na.* &c. 2, *Aq.* 1).

Achmite (*Si.* 11, *Fe.* 6½, *Na.* 2½).

Non-aluminous Silicates containing the Oxides of Iron and Manganese, and Chloride of Iron.

Pyrodmalite (*Si.* 7, *Fe.*¹ 4½, *Mn.*¹ 4½, *Cl.* *Fe.* 3, *Aq.* &c. 1).

*Non-aluminous Silicates, containing Oxide of Manganese.*Rhodonite (Si. 8, Mn. $10\frac{1}{2}$, Fe. 1, Aq. $\frac{1}{2}$).

Opsimose (Si. 5, Mn. 12, Aq. 3).

Marcelline (Si. 5, Mn. 14, Fe. &c. 1).

*Non-aluminous Silicates, containing Oxide of Zinc.*Electro-Calamine (Si. $5\frac{1}{2}$, Zn. 13, Aq. $1\frac{1}{2}$).*Non aluminous Silicates containing Oxide of Cerium.*Cerite (Si. $3\frac{1}{2}$, Ce. 14, Aq. $2\frac{1}{2}$).*Non-aluminous Silicates containing Oxide of Thorium.*

Thorite (Si. 4, Th. 10, Fe., Mn., Ca., &c. 4, Aq. 2).

Non-aluminous Silicates containing Zirconia.

Zircon (Si. 6, Zr. 14).

Eudyalite (Si. $10\frac{1}{2}$, Zr. $2\frac{1}{2}$, Na. $2\frac{1}{2}$, Ca. 2, Fe., Mn., &c. $2\frac{1}{2}$).*Non-aluminous Silicates containing Yttria.*

Gadolinite (Si. 5, Y. 9, Ce. 4, Fe. 2 (Berz.); or Si. 5, Y. 9, G. 2, Ce. 1, Fe. 3 (Thompson)).

Non-aluminous Silicates containing Magnesia; also Magnesia and Water, and Magnesia and Oxide of Iron.

Chrysolite (Si. 8, Mg. 10, Fe. 2).

Steatite (Si. 12, Mg. 6, Fe. and Aq. 2).

Talc (Si. $12\frac{1}{2}$, Mg. 6, Fe. and Aq. $1\frac{1}{2}$).Serpentine (Si. $8\frac{1}{2}$, Mg. 8, Fe. &c. 1, Aq. $2\frac{1}{2}$).

Picrosmine (Si. 11, Mg. 7, Aq. &c. 2).

Picrolite (Si. $7\frac{1}{2}$, Mg. 8, Fe. &c. 2, Aq. $2\frac{1}{2}$).Marmolite (Si. $7\frac{1}{2}$, Mg. $9\frac{1}{2}$, Aq. 3).

Keffekil (Si. 5, Mg. 10, Aq. 5).

Schiller Spar (Si. 9, Mg. 5, Fe. 3, Aq. 3).

Bronzite (Si. 11, Mg. 7, Fe. 2).

Anthophyllite* (Si. $11\frac{1}{2}$, Mg. 5, Fe. &c. $3\frac{1}{2}$).

Hypersthene (Si. 11, Mg. 3, Fe. &c. 6).

*Non-aluminous Silicates containing Magnesia and Lime.*Augite (Si. $11\frac{1}{2}$, Mg. 4, Ca. $3\frac{1}{2}$, Fe. 1, white augite, or diopside; Si. $10\frac{1}{2}$, Mg. 2, Ca. 4, Fe. $3\frac{1}{2}$, dark augite).Hornblende (Si. 12, Mg. 5, Ca. 3, white hornblende or tremolite; Si. 11, Mg. 2, Ca. 2, Fe. 5, actynolite; Si. 9, Mg. $3\frac{1}{2}$, Ca. 3, Fe. &c. 2, Al. $2\frac{1}{2}$, dark hornblende).Mellilite (Si. $7\frac{1}{2}$, Mg. 4, Ca. 4, Fe. &c. $3\frac{1}{2}$, Ti. 1).*Non-aluminous Silicates containing Magnesia and Fluoride of Magnesium.*

Condroidite (Si. 6, Mg. 9, Fl. 3, Mg. 2).

*Non-aluminous Silicates containing Lime, and Lime and Water.*Wollastonite (Si. $10\frac{1}{2}$, Ca. $9\frac{1}{2}$).

* This mineral is placed here on the authority of Gmelin and Thompson. The analysis of John would give: Si. 12, Al. 3, Mg. and Ca. 2, Fe. &c. 3.

Gismondine (*Si.* 8, *Ca.* 10, *Fe.* &c. 2).

Okenite (*Si.* 11, *Ca.* 5, *Aq.* 4).

Dysclasite (*Si.* 11, *Ca.* 6, *Aq.* 3).

Non-aluminous Silicates containing Lime and Potassa.

Apophyllite (*Si.* 10½, *Ca.* 5, *K.* 1, *Aq.* 3½).

Simple Aluminous Silicates.

Kyanite (*Si.* 7, *Al.* 13).

Sillimanite (*Si.* 9, *Al.* 11).

Fibrolite (*Si.* 8, *Al.* 12).

Bucholzite (*Si.* 9, *Al.* 11).

Andalousite* (*Si.* 7½, *Al.* 12½).

Chiastolite (*Si.* 14, *Al.* 6).

Simple Aluminous Silicates containing Water, and also simple Ferrugino-aluminous Silicates, with and without Water.

Kollyrite (*Si.* 3, *Al.* 9, *Aq.* 8).

Lenzinite (*Si.* 8, *Al.* 7, *Aq.* 5).

Severite (*Si.* 10, *Al.* 5, *Aq.* 5).

Scarbrite (*Si.* 2, *Al.* 8, *Aq.* 10).

Allophane (*Si.* 5, *Al.* 7½, *Aq.* 7½).

Halloysite (*Si.* 8, *Al.* 7, *Aq.* 5).

Hisingerite (*Si.* 5½, *Al.* 1, *Fe.* 9½, *Aq.* 2½, loss 1½).

Staurolite (*Si.* 6, *Al.* 10, *Fe.* 4).

Ferrugino-aluminous Garnet (*Si.* 8, *Al.* 7, *Fe.* 4, *Mn.* 1).

Aluminous Silicates containing Oxide of Iron and Magnesia.

Sordawalite (*Si.* 10, *Al.* 3, *Fe.* 3, 4, *Mg.* 2, *Aq.* &c. 1).

Fahlunite (*Si.* 9, *Al.* 6, *Fe.* 1½, *Mg.* 1½, *Aq.* 2).

Chlorite (*Si.* 6, *Al.* 3, *Fe.* 5, *Mg.* 4½, *Aq.* 1½).

Anthophyllite (*Si.* 12, *Al.* 3, *Mg.* and *Ca.* 2, *Fe.* 3).

Aluminous Silicates containing Oxide of Iron and Lime.

Isopyre (*Si.* 10, *Al.* 3, *Ca.* 3, *Fe.* 4).

Epidote (*Si.* 8, *Al.* 6, *Ca.* 3, *Fe.* 3).

Xanthite (*Si.* 7, *Al.* 2, *Ca.* 8, *Fe.* 3).

Axinite (*Si.* 9, *Al.* 4, *Ca.* 3½, *Fe.* 3, *B.* ½).

Aluminous Silicates containing Oxide of Nickel.

Pimelite,† (*Si.* 7, *Al.* 1, *Ni.* 3, *Aq.* 7½, other ingredients 1½).

Aluminous Silicates containing Oxide of Manganese.

Manganesian Garnet (*Si.* 7½, *Al.* 3½, *Mn.* 6, *Fe.* 3).

Karpholite (*Si.* 7½, *Al.* 5½, *Mn.* 4, *Fe.* &c. 1, *Aq.* 2).

* *Vauquelin's* analysis of this mineral gave eight per cent. of potassa, but the above accords with those of *Bucholz*, *Thomson*, and *Coverdale*.

† This mineral is perhaps more correctly a simple hydrated silicate of nickel.

*Aluminous Silicates containing Glucina.*Euclase (Si. 9, Al. 6, G. $4\frac{1}{2}$, Fe. &c. $\frac{1}{2}$).Emerald (Si. $13\frac{1}{2}$, Al. $3\frac{1}{2}$, G. 3).**Aluminous Silicates containing Magnesia.*

Iolite (Si. 10, Al. 7, Mg. 2, Fe. &c. 1).

Nephrite (Si. 10, Al. 2, Mg. $6\frac{1}{2}$, Fe. &c. 1, Aq. $\frac{1}{2}$).Kerolite (Si. $7\frac{1}{2}$, Al. $2\frac{1}{2}$, Mg. $3\frac{1}{2}$, Aq. $6\frac{1}{2}$).

Pyrophyllite (Si. 12, Al. 6, Mg. 1, Aq. 1).

*Aluminous Silicates containing Magnesia and Potassa.*Mica: some varieties (Si. $8\frac{1}{2}$, Al. 3, Mg. $5\frac{1}{2}$, K. $1\frac{1}{2}$, Fe. $1\frac{1}{2}$).*Aluminous Silicates containing Magnesia and Chromic Acid.*Chrome Garnet or Pyrope (Si. $8\frac{1}{2}$, Al. $4\frac{1}{2}$, Mg. 1, Cr. 2, Ca. $1\frac{1}{2}$, Fe. 2).*Aluminous Silicates containing Lime, and Lime and Water.*

Calcareo-aluminous Garnet (Si. 8, Al. 4, Ca. 7, Fe. &c. 1).

Idocrase (Si. $8\frac{1}{2}$, Al. $3\frac{1}{2}$, Ca. 7, Fe. 1).

Zoisite (Si. 8, Al. 6, Ca. 5, Fe. 1).

Wernerite (Si. 9, Al. 7, Ca. 4).

Gehlenite (Si. 6, Al. 5, Ca. 7, Fe. 1, Aq. 1).

Labradorite (Si. $11\frac{1}{2}$, Al. $5\frac{1}{2}$, Ca. 3).

Indianite (Si. 9, Al. 8, Ca. 3).

Prehnite (Si. $8\frac{1}{2}$, Al. 5, Ca. $4\frac{1}{2}$, Fe. 1, Aq. 1).Davyne (Si. $8\frac{1}{2}$, Al. $6\frac{1}{2}$, Ca. $2\frac{1}{2}$, Aq. $2\frac{1}{2}$).Stilbite (Si. $10\frac{1}{2}$, Al. $3\frac{1}{2}$, Ca. 2, Aq. 4).

Heulandite (Si. 12, Al. 3, Ca. 3, Aq. 2).

Laumonite (Si. $10\frac{1}{2}$, Al. $4\frac{1}{2}$, Ca. 2, Aq. 3).

Hypostilbite (Si. 10, Al. 4, Ca. &c. 2, Aq. 4).

Epistilbite (Si. 12, Al. $3\frac{1}{2}$, Ca. 2, Aq. $2\frac{1}{2}$).

Spherostilbite (Si. 11, Al. 3, Ca. 2, Aq. 4).

Comptonite (?).

Chabasite (Si. 10, Al. 4, Ca. 2, Aq. 4).

Levyne (Si. $9\frac{1}{2}$, Al. $4\frac{1}{2}$, Ca. 2, Aq. 4).*Aluminous Silicates containing Lime and Magnesia.*

Anorthite (Si. 9, Al. 7, Ca. 3, Mg. 1).

Humboldtite (Si. 9, Al. 2, Ca. 6, Mg. and Na. 3).

Erlanite (Si. 11, Al. 3, Ca. 3, Mg. and Na. 2, Fe. 1).

*Amphodelite.**Aluminous Silicates containing Lime and Soda.*Thomsonite (Si. $7\frac{1}{2}$, Al. 6, Ca. 3, Na. 1, Aq. $2\frac{1}{2}$).

Gmelinite (Si. 10, Al. 4, Ca. 1, Na. 1, Aq. 4).

Scolezite (Si. $9\frac{1}{2}$, Al. 5, Ca. 2, Na. 1, Aq. $2\frac{1}{2}$).

Saussurite (Si. 10, Al. 5, Ca. 2, Na. with Mg. 2, Fe. 1).

Edingtonite (see p. 60).

Lazulite (Si. 10, Al. $2\frac{1}{2}$, Ca. $3\frac{1}{2}$, Na. &c. $2\frac{1}{2}$, Fe. 1, S. $\frac{1}{2}$).

Ittnerite (see p. 87).

* The deep-green varieties contain also a small portion of oxide of chromium, to which their fine colour is attributed.

Aluminous Silicates containing Lime and Potassa.

- Phillipsite (Si. 9, Al. $4\frac{1}{2}$, Ca. $1\frac{1}{2}$, K. $1\frac{1}{2}$, Aq. $3\frac{1}{2}$).
 Latrobeite (Si. 9, Al. 7, Ca. 2, K. 1, Mn. 1).
 Nuttallite (Si. 8, Al. 5, Ca. $3\frac{1}{2}$, K. $1\frac{1}{2}$, Fe. 2).
 Glaucolite (Si. 11, Al. 6, Ca. 2, K. 1).
 Couseranite (Si. $10\frac{1}{2}$, Al. 5, Ca. $2\frac{1}{2}$, K. &c. 2).

Aluminous Silicates containing Lime, Potassa, and Sulphuric Acid.

- Hauyne (Si. $7\frac{1}{2}$, Al. 4, Ca. $2\frac{1}{2}$, K. 3, S. with Aq. &c. 3).

Aluminous Silicates containing Strontia.

- Brewsterite (Si. $10\frac{1}{2}$, Al. $3\frac{1}{2}$, Sr. 2, Ba. $1\frac{1}{2}$, Aq. $2\frac{1}{2}$).

Aluminous Silicates containing Baryta.

- Harmotome (Si. 10, Al. $3\frac{1}{2}$, Ba. $3\frac{1}{2}$, Aq. 3).

Aluminous Silicates containing Soda.

- Nepheline (Si. 9, Al. 7, Na. 4).
 Elaeolite (Si. 9, Al. 7, Na. 3, K. 1).
 Albite (Si. 14, Al. 4, Na. 2).
 Pericline (Si. 14, Al. $3\frac{1}{2}$, Na. $2\frac{1}{2}$).
 Cancrinite.
 Sphærolite (Si. 16, Al. 2, Na., K., Fe., &c. 2).
 Obsidian (Si. 16, Al. 2, Na., K., &c. 2).

Aluminous Silicates containing Soda and Water.

- Mesotype (Si. 10, Al. 5, La. $3\frac{1}{2}$, Aq. $1\frac{1}{2}$).
 Analcime (Si. 11, Al. $4\frac{1}{2}$, La. 3, Aq. $1\frac{1}{2}$).

Aluminous Silicates containing Soda and Sulphuric Acid.

- Spinellane (Si. 8, Al. 6, Na. 4, S. and Aq. 2).

Aluminous Silicates containing Soda and Hydrochloric Acid.

- Sodalite (Si. 7, Al. $6\frac{1}{2}$, Na. $5\frac{1}{2}$, Hydrochloric Acid 1).

Aluminous Silicates containing Potassa.

- Feldspar (Si. 13, Al. 4, K. 3).
 Pinite (Si. 11, Al. 5, K. &c. 2, Fe. &c. 2).
 Mica: some varieties (Si. $9\frac{1}{2}$, Al. $7\frac{1}{2}$, K. 2, Fe. &c. 1).
 Killinite (Si. 10, Al. 6, K. &c. 2, Aq. 2).
 Agalmatolite (Si. 11, Al. 6, K. &c. 2, Aq. 1).

Aluminous Silicates containing Lithia.

- Petalite (Si. 16, Al. 3, L. 1).
 Spodumene (Si. 13, Al. 5, L. 2; or Si. 13, Al. 6, L. 1).
 Mica: some varieties (See p. 47).

Aluminous Silicates containing Boracic Acid.

- Tourmaline* (Si. 8, Al. 8, B. 1, Mg., L., Na., &c. 2, Fe. 1).
 Note.—The Axinite might also be arranged under this head.

* The analyses of this mineral vary considerably, but all the modern analysts enumerate Boracic Acid as a constituent part. See page 106.

*Aluminous Silicates containing Fluorine.*Topaz (*Si.* 7, *Al.* 8, *F.* 3, *Al.* 2).Pycnite (*Si.* *Al.* 16½, *F.* *Al.* 3½).*Note.*—Some varieties of Mica might also be arranged here.

K. BORATES.

Substances which are partly soluble in nitric acid, leaving a residue that imparts to alcohol the property of burning with a green flame.

*Simple Borates.*Boracite (*B.* 14, *Mg.* 6).Borax (*B.* 7½, *Na.* 3, *Aq.* 9½).*Silico-Borates.*Datholite (*B.* 4½, *Si.* 7½, *Ca.* 7, *Aq.* 1).

L. PHOSPHATES.

Substances which, when fused with carbonate of soda, form, with water, a solution which yields a white precipitate with the nitrates of lead, zinc, or mercury, and a yellow precipitate with nitrate of silver.

Pyromorphite (*P.* 3, *Pb.* 15+*Cl.* *Pb.* 2).Aphrese or Libethenite (*P.* 6, *Cu.* 12½, *Aq.* 1½).Ypoleme or Rhenite (*P.* 4½, *Cu.* 12½, *Aq.* 3).Vivianite (*P.* 6, *Fe.* 8, *Aq.* 6).*Karphosiderite.*Triplite (*P.* 7, *Mn.* 7, *Fe.* 6).Heterosite (*P.* 8½, *Mn.* 3½, *Fe.* 7, *Aq.* 1).Hureaulite (*P.* 7½, *Mn.* 6½, *Fe.* 2½, *Aq.* 3½).Uranite (*P.* 3, *U.* 12, *Ca.*, &c. 2, *Aq.* 3).Chalkolite (*P.* 3, *U.* 12, *Cu.* 2, *Aq.* 3).Phosphyttrite (*P.* 7, *Y.* 13).Wagnerite (*P.* 8½, *Mg.* 7½+*F.* 2½, *Mg.* 1½).Apatite (*P.* 8½, *Ca.* 10+*F.* *Ca.* 1½).Wavellite (*P.* 6½, *Al.* 6½, *Aq.* 6+*F.* *Al.* 1).*Kakoxene.**Childrenite.**Turquoise or Calaité.*Klaprothine (*P.* 8½, *Al.* 7, *Mg.* 2½, *Si.*, *Fe.*, &c. 1, *Aq.* 1).Amblygonite (*P.* 11, *Al.* 7½, *L.* 1½).

M. ARSENIATES.

Substances which are partly volatilizable before the blow-pipe on charcoal, with a strong alliaceous odour. No metallic lustre.

Mimetese (*As.* 4, *Pb.* 14+*Cl.* *Pb.* 2; or *As.* 2½, *P.* 1½, *Pb.* 14+*Cl.* *Pb.* 2).Olivinite* (*As.* 7½, *P.* ½, *Cu.* 11½, *Aq.* ½).Erinite (*As.* 7, *Cu.* 12, *Aq.* 1).Aphanese (*As.*, *Cu.*, *Aq.*).

* The composition of this and of the following Arseniates of Oxide of Copper is at present but imperfectly known.

Euchroite (*As.* $9\frac{1}{2}$, *Cu.* $6\frac{1}{2}$, *Aq.* 4).
 Leirochroite (*As.*, *Cu.*, *Aq.*).
 Euchlorose (*As.* 8, *Cu.* $8\frac{1}{2}$, *Aq.* $3\frac{1}{2}$).
 Liroconite (*As.* 3, *Cu.* 10, *Aq.* 7).
 Scorodite (*As.*, *Cu.*, *Fe.*, *Aq.*).
 Pharmacosiderite (*As.* 8, *Fe.* 8, *Aq.* 4).
 Neoctese (*As.* 10, *Cu.* 7, *Aq.* 3).
 Sideratine (*As.* 4, *S.* 3, *Fe.* 7, *Aq.* 6).
 Arseniate of Nickel (*As.* $7\frac{1}{2}$, *Ni.* $7\frac{1}{2}$, *Aq.* 5).
 Erythrine (*As.* $7\frac{1}{2}$, *Co.* 8, *Aq.* $4\frac{1}{2}$).
 Pharmacolite (*As.* 10, *Ca.* 5, *Aq.* 5).
 Haidingerite (*As.* *Ca.* 17, *Aq.* 3).

N. SULPHATES.

Substances which, when fused with carbonate of soda on charcoal and moistened with acidulated water, give out sulphuretted hydrogen, known by its disagreeable and peculiar odour.* No metallic lustre.

Anglesite (*S.* $5\frac{1}{2}$, *Pb.* $14\frac{1}{2}$).
 Cupreous Sulphate of Lead (*S.* *Pb.* 15, *Cu.* 4, *Aq.* 1).
 Cyanhalose *S.* $6\frac{1}{2}$, *Cu.* $6\frac{1}{2}$, *Aq.* 7).
 Brochantite (*S.* $3\frac{1}{2}$, *Cu.* 14, *Aq.* $2\frac{1}{2}$).
Konigine.
Velvet Blue Copper.
 Melantherite (*S.* 6, *Fe.* 5, *Aq.* 9).
 Botryogene (*S.* $6\frac{1}{2}$, *Fe.*³ $4\frac{1}{2}$, *Fe.*¹ 2, *Aq.* 7).
 Pittizite (*S.* 3, *Fe.*³ 13, *Aq.* 4).
 Rhodhalose (*S.* 6, *Co.* 6, *Aq.* 8).
 Gallitzinite (*S.* 5, *Zn.* 6, *Aq.* 9).
 Johannite (*S.*, *U.*, *Cu.* *Aq.*)
 Epsomite (*S.* $6\frac{1}{2}$, *Mg.* $3\frac{1}{2}$, *Aq.* 10).
 Polyhallite (*S.* *Mg.* 4, *S.* *Ca.* $4\frac{1}{2}$, *S.* *Ca.* *Aq.* 6, *S.* *K.* $5\frac{1}{2}$).
 Anhydrite (*S.* $11\frac{1}{2}$, *Ca.* $8\frac{1}{2}$).
 Gypsum (*S.* 9, *Ca.* 7, *Aq.* 4).
 Glauberite (*S.* *Ca.* 10, *S.* *Na.* 10).
 Celestine (*S.* $8\frac{1}{2}$, *Sr.* $11\frac{1}{2}$).
 Barytine (*S.* 7, *Ba.* 13).
 Thenardite (*S.* *Na.*).
 Exanthalose (*S.* 9, *Na.* 7, *Aq.* 4).
 Apthalose (*S.* *K.*).
 Websterite (*S.* 5, *Al.* 6, *Aq.* 9).
 Alunogene (*S.* $7\frac{1}{2}$, *Al.* 3, *Aq.* $9\frac{1}{2}$).
 Soda-Alum (*S.* $7\frac{1}{2}$, *Al.* $2\frac{1}{2}$, *Na.* $1\frac{1}{2}$, *Aq.* $8\frac{1}{2}$).
 Alumstone (*S.* 7, *Al.* 8, *K.* 2, *Aq.* 3).
 Alum (*S.* 7, *Al.* 2, *K.* 2, *Aq.* 9).
 Amonalum (*S.* $7\frac{1}{2}$, *Al.* $2\frac{1}{2}$, *Ammonia* 1, *Aq.* 9).

O. CARBONATES.

Substances which are soluble with more or less effervescence in hot or cold acids, disengaging carbonic acid gas. No metallic lustre. H. under 4.5. Sk. not red.

* See also Chapter I.

*Carbonate of Bismuth.*Lead-Spar (*C.* 3, *Pb.* $16\frac{1}{2}$, *Aq.* $\frac{1}{2}$).Leadhillite (*C.* *Pb.* 14, *S.* *Pb.* 6).Lanarkite (*C.* *Pb.* 9, *S.* *Pb.* 11).Caledonite (*C.* *Pb.* $6\frac{1}{2}$, *C.* *Cu.* $2\frac{1}{2}$, *S.* *Pb.* 11).Cuprazurite (*C.* 5, *Cu.*¹ 14, *Aq.* 1).Malachite (*C.* 4, *Cu.*² 14, *Aq.* 2).Siderose (*C.* 8, *Fe.* 12).Manganese Spar (*C.* $7\frac{1}{2}$, *Mn.* $11\frac{1}{2}$, *Ca.* 1).Smithsonite (*C.* 7, *Zn.* 13).Zinconise (*C.* $2\frac{1}{2}$, *Zn.* $13\frac{1}{2}$, *Aq.* 4).*Carbonate of Oxide of Cerium.*Magnesite (*C.* $10\frac{1}{2}$, *Mg.* $9\frac{1}{2}$).Breunnerite (*C.* 10, *Mg.* 9, *Fe.* 1).Magneso-Calcite (*C.* *Ca.* 14, *C.* *Mg.* 6).Ankerite (*C.* with *Fe.* 7, *Ca.* 10, *Mg.* $2\frac{1}{2}$, *Mn.* $\frac{1}{2}$).Calcite (*C.* $11\frac{1}{2}$, *Ca.* $7\frac{1}{2}$).Arragonite (*C.* *Ca.* with very small proportions of *C.* *Sr.* and *Aq.*)Strontianite (*C.* 6, *Sr.* 14).*Stromnite.*Witherite (*C.* $15\frac{1}{2}$, *Ba.* $4\frac{1}{2}$).Baryto-Calcite (*C.* *Ba.* 13, *C.* *Ca.* 7).Gaylussite (*C.* 6, *Na.* 4, *Ca.* $3\frac{1}{2}$, *Aq.* $6\frac{1}{2}$).Natron (*C.* 7, *Na.* 10, *Aq.* 3).Trona (*C.* 3, *Na.* $7\frac{1}{2}$, *Aq.* $4\frac{1}{2}$).

P. NITRATES.

Substances soluble in water; deflagrating more or less, when mixed with charcoal, before the blow-pipe; and giving out the red fumes of nitrous acid when mixed with copper filings and subjected to the action of sulphuric acid.

Nitrate of Magnesia (*N.* $14\frac{1}{2}$, *Mg.* $4\frac{1}{2}$).Nitrate of Lime (*N.* $13\frac{1}{2}$, *Ca.* $6\frac{1}{2}$).Nitrate of Soda (*N.* $12\frac{1}{2}$, *Na.* $7\frac{1}{2}$).Nitre (*N.* 9, *K.* 11).

FLUORIDES.

Substances giving, by fusion in a small tube with phosphoric acid, a vapour which strongly corrodes the glass (Beud.).

Fluocerine (*F.* 7, *Ce.* 13).Basicerine (*F.* $5\frac{1}{2}$, *Ce.* $13\frac{1}{2}$, *Aq.* 1).Yttrocerite (*F.*, *Ce.*, *Y.*, *Ca.*).Fluor Spar (*F.* $9\frac{1}{2}$, *Ca.* $10\frac{1}{2}$).Cryolite (*F.* 11, *Na.* $6\frac{1}{2}$, *Al.* $2\frac{1}{2}$).*Fluellite.*

Note.—The Topaz, Pycnite, and Condrodite, might be arranged here under the title of "Silico-Fluorides."

CHLORIDES.

Substances imparting to the flame, when fused with microscomic salt and oxide of copper (previously melted together), a fine purplish-blue colour.

Kerargyrite (*Cl.* 5, *Ag.* 15).

Chloride of Mercury (Cl. 3, Hg. 17).
 Cotunnite (Cl. 5, Pb. 15).
 Mendipite (Cl. Pb. 7, *Pb.* 11, *C. Pb.* 2).
 Matlockite (Cl. Pb. 10, *Pb.* 2½, *C. Pb.* 7½).
 Atakamite (Cl. Cu. 6, *Cu.* 11, *Aq.* 3).
Chloride of Magnesium.
Chloride of Calcium.
 Rock Salt (Cl. 12, Na. 8).
Chloride of Potassium.
 Sal Ammoniac.
 Hydro-Chloric Acid (Cl. H. 15, *Aq.* 1).

IODIDES.

BROMIDES.

ORGANICO-CHEMICAL SUBSTANCES.

Mellite. Mellate of Alumina.
 Humboldtite. Oxalate of Iron.
 Amber.
 Fossil Copal.
 Schererite.
 Hatchetine.
 Ozokerite.
 Retinasphalt.
 Dysodile.
 Anthracite.
 Bituminous Coal.
 Mineral Pitch.
 Mineral Oil, &c., &c., &c.
 The gases, Carburetted Hydrogen, Phosphuretted Hydrogen, &c.,
 may also be comprised in this division.

Note.—Anthracite is by some mineralogists arranged as “Native Carbon,”
 but, as it is evidently coal altered by subterranean heat, the present seems
 to be its fitter place.



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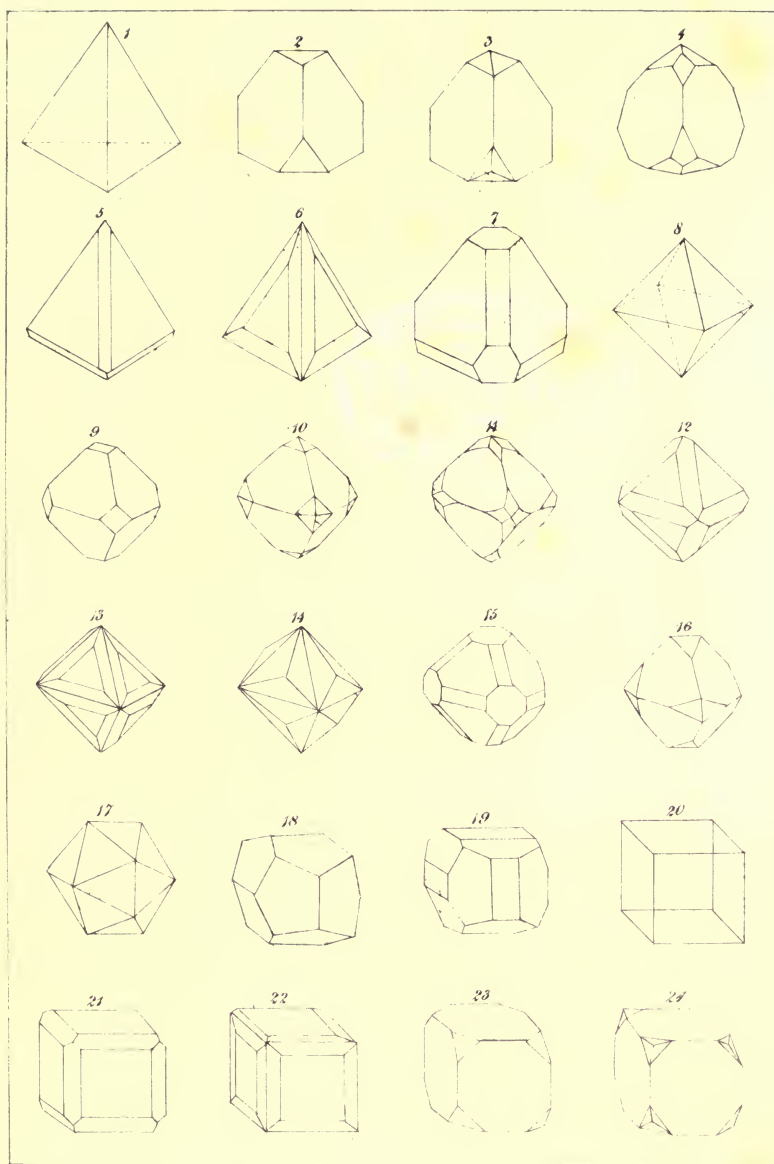
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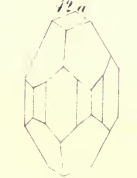
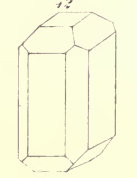
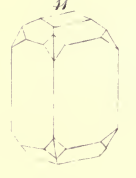
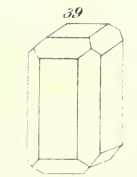
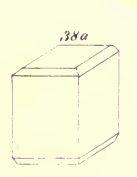
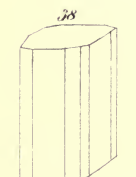
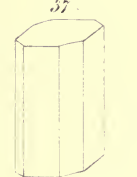
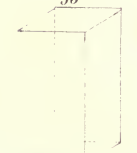
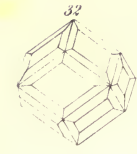
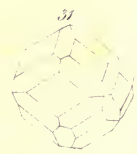
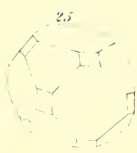
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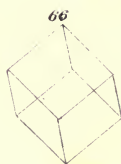
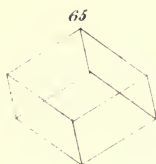
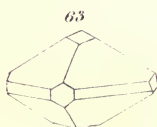
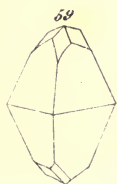
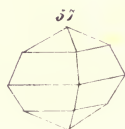
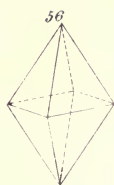
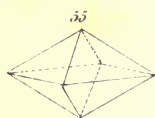
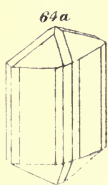
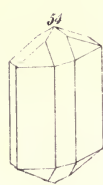
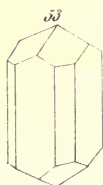
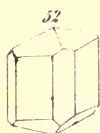
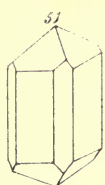
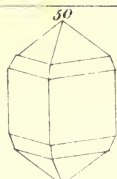
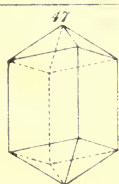














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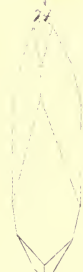
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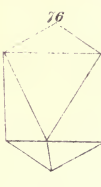
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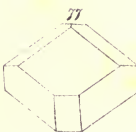
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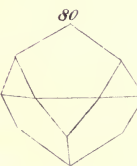
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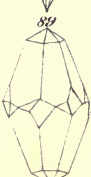
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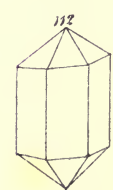
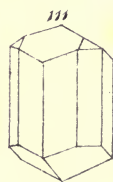
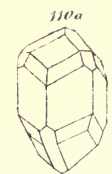
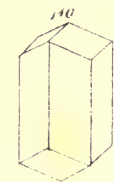
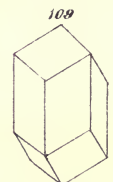
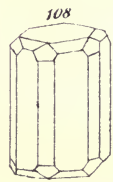
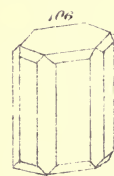
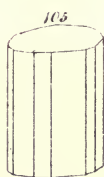
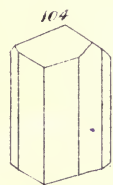
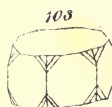
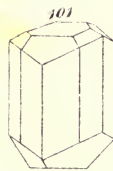
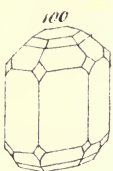
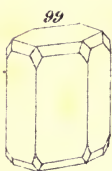
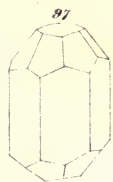
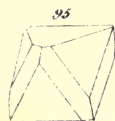


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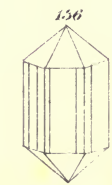
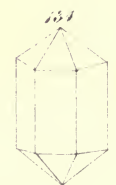
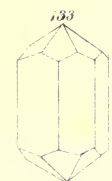
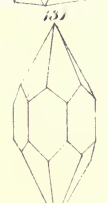
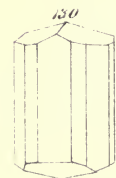
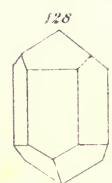
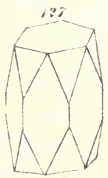
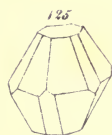
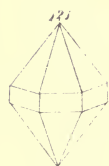
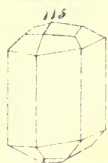
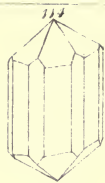
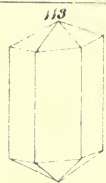


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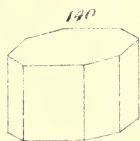
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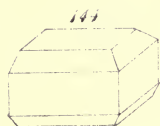
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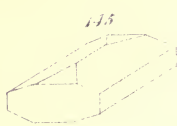
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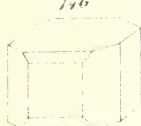
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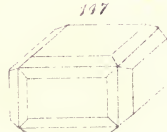
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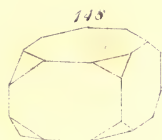
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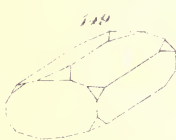
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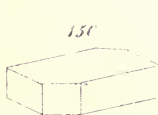
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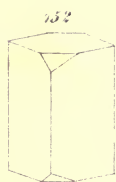
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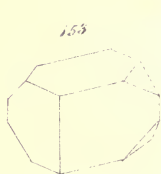
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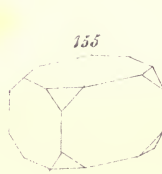
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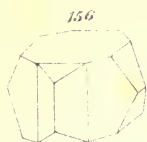
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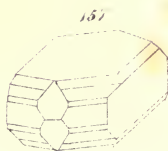
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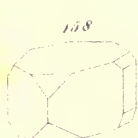
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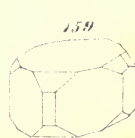
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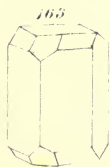
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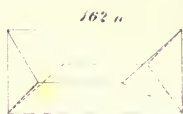
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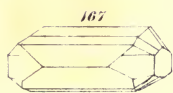
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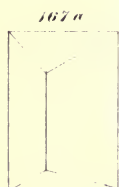
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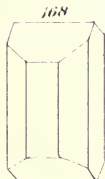
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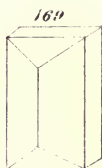
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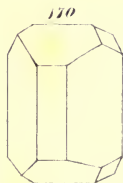
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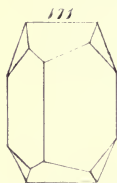
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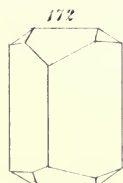
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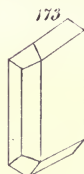
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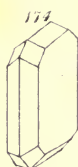
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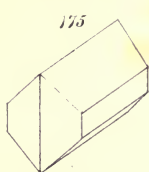
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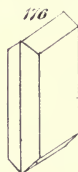
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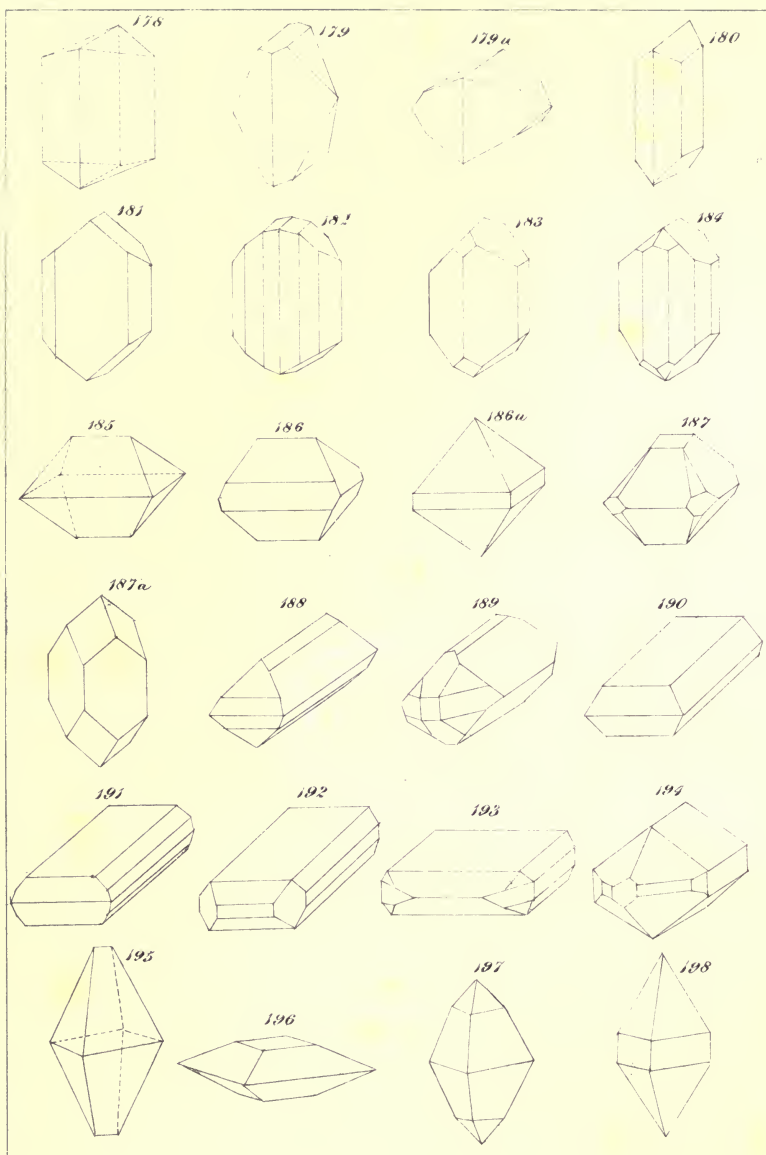


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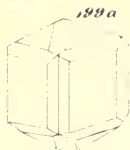




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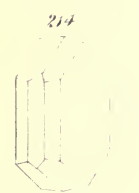
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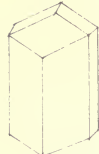
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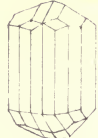
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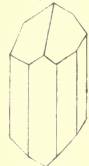
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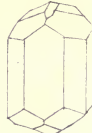
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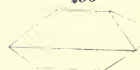
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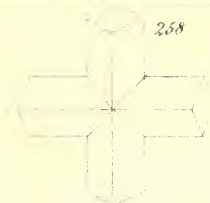
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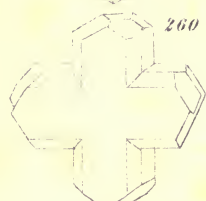
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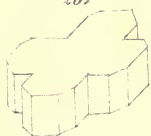
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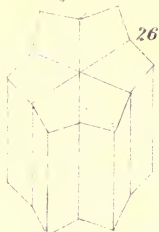
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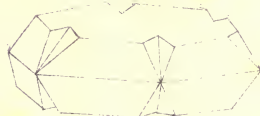
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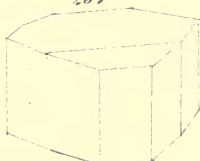
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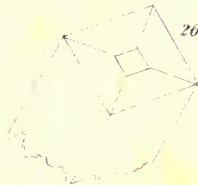
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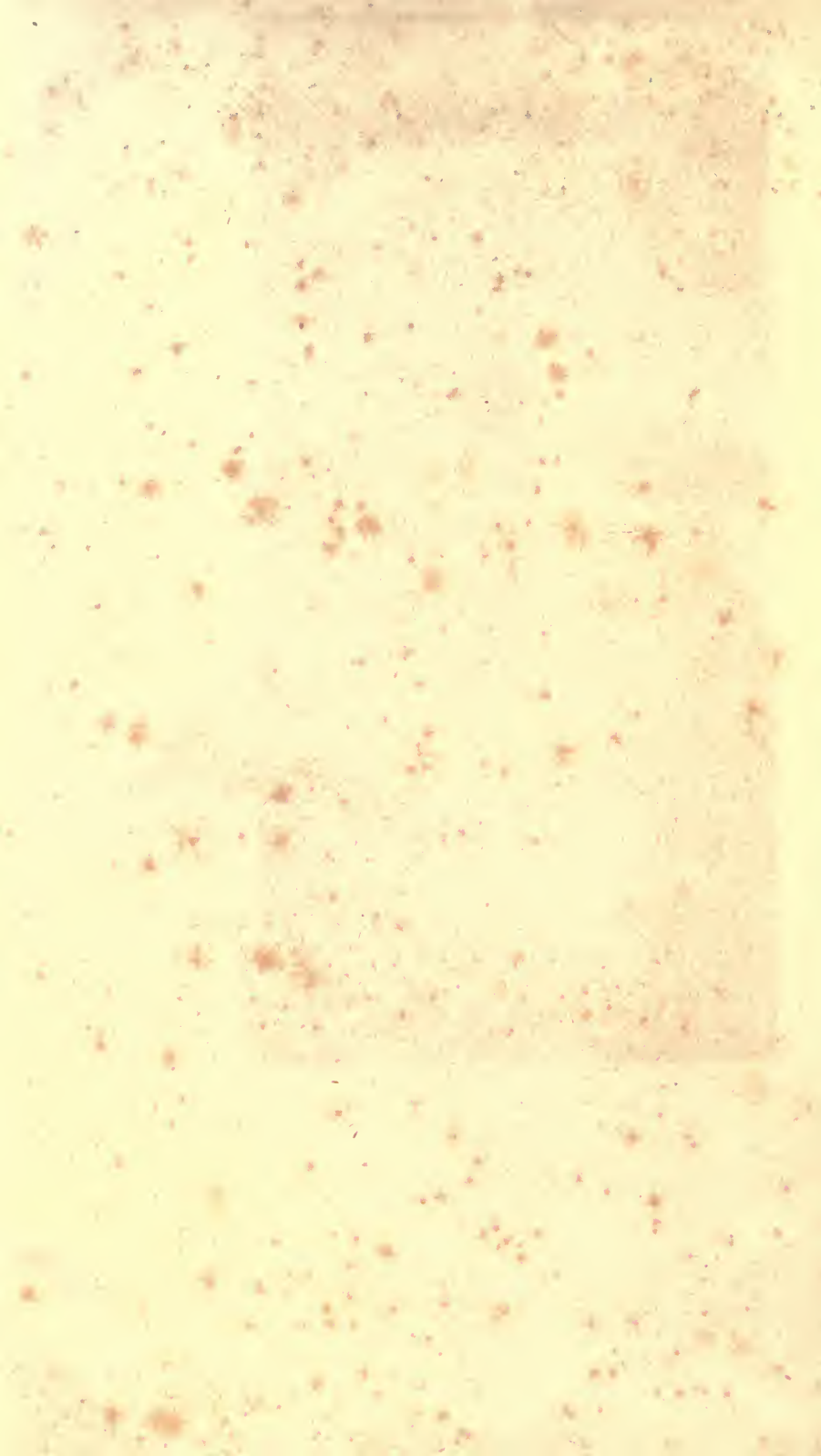
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THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

SEP 21 1914

OCT 4 1915

SEP 28 1916

SEP 28 1917

OCT 13 1917

SEP 22 1918

SEP 29 1919

SEP 20 1920

SEP 20 1920

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Chapman

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